DOCUMENT RESUME

ED 113 895 EC 080 249

TITLE An Instructional Playground for the Handicapped Using Tires as Inexpensive Playground Equipment: Activity and Construction Manual.

INSTITUTION New York State Education Dept., Albany. Special Education Instructional Materials Center.

NOTE 57p.

EDRS PRICE MF-$0.76 HC-$3.32 Plus Postage

DESCRIPTORS *Adapted Physical Education; Equipment; Exceptional Child Education; *Handicapped Children; *Manuals; *Playgrounds; *Prevocational Education; Special Education; Student Participation; Teaching Guides

IDENTIFIERS Tires

ABSTRACT

The manual explains how special education students in an occupational program used tires to construct an inexpensive instructional playground for handicapped elementary school pupils. Presented in two sections with accompanying pictures or diagrams are activity ideas for using the tires in a variety of configurations (Part 1) and construction and installation instructions (Part 2) both within the school shop setting and at the playground site. Listed in a brief introductory section are the following project benefits: students' satisfaction, increased interaction between special education and physical education staff members and between students in special and regular classes, equipment safety, and low cost (under $400) of constructing the playground. (LH)

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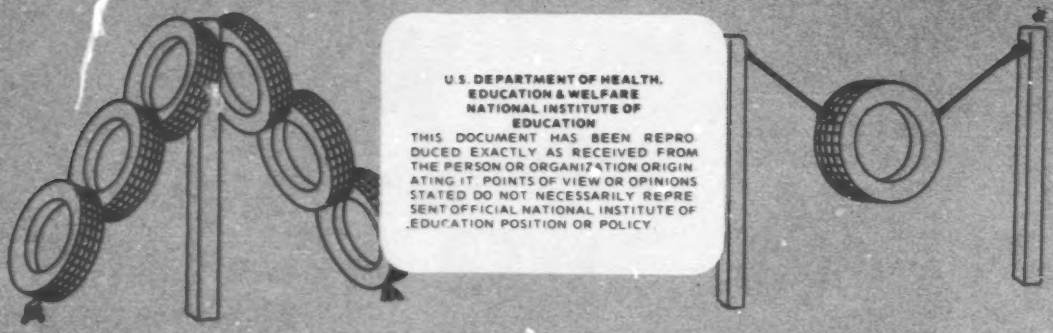

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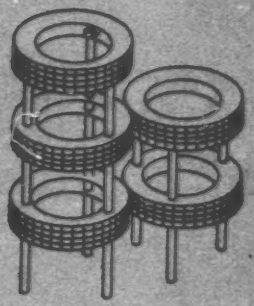
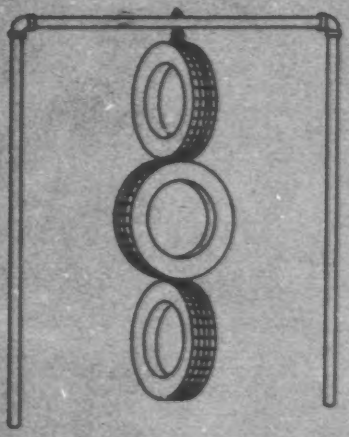
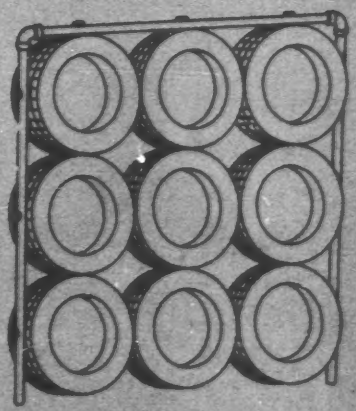
An Instructional Playground For The Handicapped

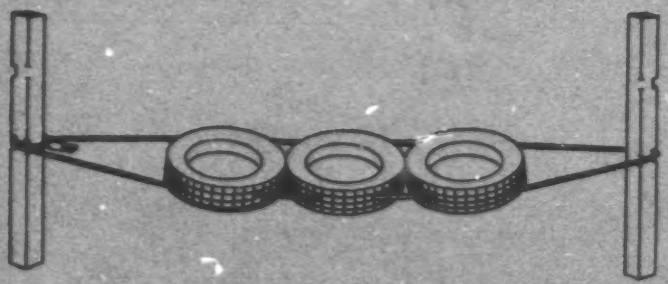
Using tires as inexpensive playground equipment





Activity and Construction Manual





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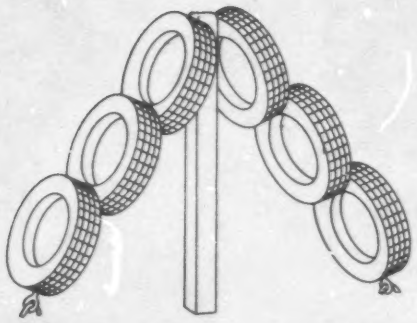

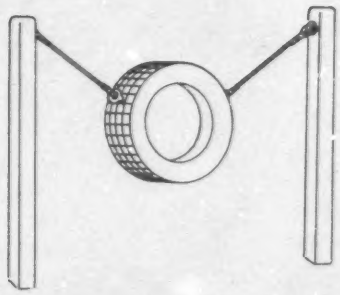

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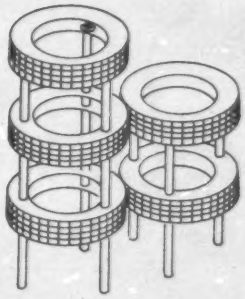

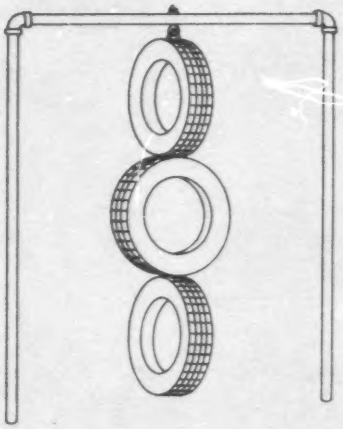

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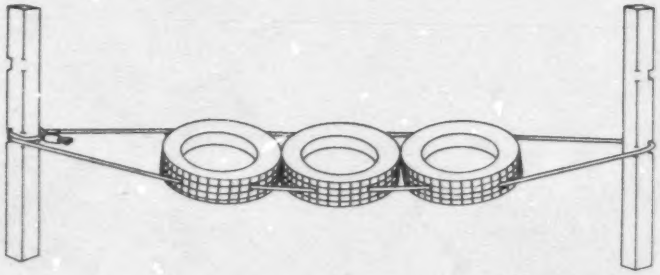

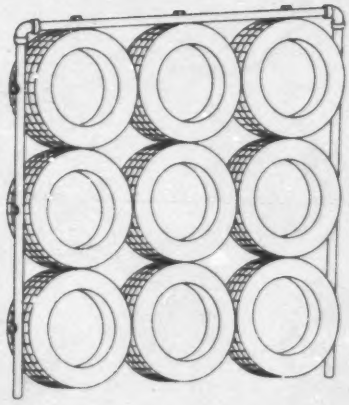

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INTRODUCTION

While there have been other tire playgrounds, this manual represents a project which is unique in several ways. First, it grew out of an expressed need and was developed with a great deal of coordinated effort, and second, the activities and construction ideas in this manual were designed with the intent that they function integrally. The primary concern was that the playground be utilized as a support in the total instructional process of the children who would be using it.

A prototype of the playground described in this manual was constructed in conjunction with the Rensselaer-Columbia BOCES in Castleton, New York. The equipment was constructed by special education students in an occupational education program. It was set up in a playground area by the same students. Classroom teachers of trainable mentally handicapped students, in conjunction with a physical education teacher, observed the children on the playground, developed activities for use of the equipment, evaluated their effectiveness, and in some cases revised and modified their ideas. The resulting construction plans, physical equipment specifications, and instructional activities evolved from this cooperative process.

There are several valuable aspects to the project and the resultant manual. The equipment can be built within a school shop setting and, if desired, the equipment can be constructed by special education students. We know that this is well within the realm of possibility because it was done successfully in the pilot study. We also discovered that the process of building materials from scratch and setting them up as a complete playground is a valuable experience from the viewpoint of the self-satisfaction of the students.

Another point that we found to be positive was the interaction between the special education and physical education staff. In this project, each brought their specific expertise to the program and gained from each other. The project can

give insight to the physical education teacher about the relationship between playground activities and the teachers' broad instructional goals and individual student objectives. The special education teachers can gain valuable information about the skill areas involved in free play and organized physical activities and then ongoing communication can begin between the physical education and special education personnel.

A third finding that was not necessarily planned, although there was some realization of the possibility, was the resultant interactions on the playground between the special education classes and the children in the regular elementary grades. It was observed that the children attending the elementary school would use the playground equipment during free play time with the special education students and would often help them in performing various activities. This type of interaction had been almost non-existant prior to the construction of the playground.

The playground was designed to be inexpensive. We found that the equipment can be used for most of the activities a common commercial playground would be used for. The savings in cost of materials are considerable. The construction of the playground, with the specific materials that were used in the pilot project, was less than $400. This can be compared with purchasing commercial equipment at a cost of several thousand dollars.

The equipment was designed to be safe for the children. The rubber tires do not constitute any danger when fallen on, rubbed against or run into. In the activities manual, there are suggestions as to what precautions should be taken in certain activities on certain units. (The combination of common sense in using the equipment and the design of the units should all but eliminate any safety hazards.)

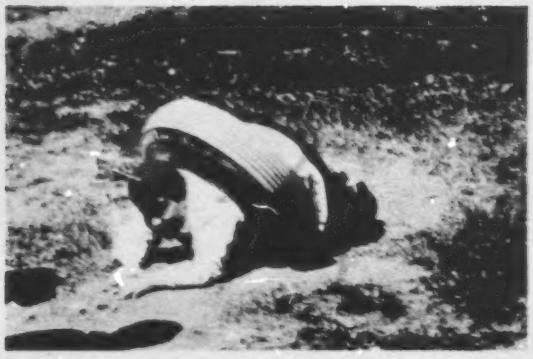
The design of this manual is not accidental. You will notice the instructional activities precede the construction section. At first glance this might seem backwards. The reasoning behind this is that we would like the project to be considered from the viewpoint of its instructional benefits as well as its playground potential. The manual can be used in any manner you might choose; if desired, a single unit or several units can be constructed. New units can be designed and new activities can be developed, but we want to discourage the use of the manual purely for construction purposes only, without thought or time taken to review the instructional activities and ideas developed in the pilot project.

Finally, this manual is not meant to be a static document. We learned many interesting things and have recorded these for future use. However, the limits of the playground idea are only the limits of the creativity and ingenuity of future users. We would appreciate feedback about new ideas for units and their instructional use. If we receive enough, we can compile and disseminate supplemental information. In any case, we hope you find this manual useful, and it increases the opportunities for students to have playground equipment available to them in those places where this opportunity has not existed before.

PART I

ACTIVITIES

Unit I



Activity #3

Activities:

1. Straddle Vault - Have the child place hands on top of tire pushing with arms, vault his body (legs apart on each side of tire) over tire.

2. Straddle Jump - The child jumps over tire - feet apart but using no hands for support.

3. Have the child crawl through the tire:

   a. head first
   b. feet first

4. Rotations

   a. Have the child place his right hand on tire and run around it in a forward motion.
   b. Have the child place his left hand on tire and run around it in a forward motion.
   c. Using the same hand placement - have the child run backwards around tire.
   d. Have the child place both hands on tire, circle tire and change directions to verbal or whistle commands.
   e. Have the child place right or left hand on tire, hop on one foot, both feet, or skip around tire.

5. Ball activities

   a. Have the child throw ball over tire.
   b. Have the child throw ball through tire.
   c. Have the child throw ball through tire for a partner to catch.

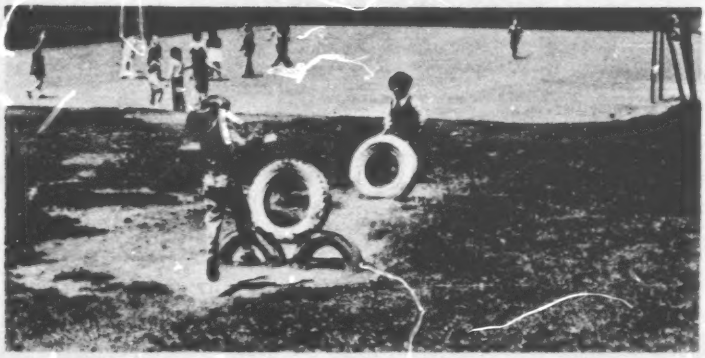
6. Fun Games

   Cat and Rat - Running around the tire, the cat (one person) chases the rat (another person). When the cat catches the rat, they change places and the game continues.

Suggestion:

1. Additional unit: a row of sunken tires with a hand rail parallel to it for balance.

Unit II



Approach for Straddle Vault

Activities:

1. Straddle Vault - Have the child place hands on top of tire pushing with arms, vault his body (legs apart on each side of tire) over tire.

2. Straddle Jump - The child jumps over tire - feet apart, but using no hands for support.

3. Have the child crawl through the top tire:

   a. head first
   b. feet first

4. Rotations - as described in Unit I - Have the child place hand on the tire and run around:

   a. forward
   b. backward
   c. using right hand
   d. using left hand
   e. using both hands

5. Ball activities

   a. Have the child throw ball through top tire.
   b. Have the child throw ball over top tire.
   c. Have the child roll soft ball (or small ball) through bottom left tire or right tire.

6. Have the child toss bean bag over lower left or lower right tire.

7. Have the child place one foot on bottom left tire, one foot on bottom right tire, place two hands on top tire - stand and balance:

   a. holding on with hands
   b. arms outstretched
   c. bend top tire and vault over tire
   d. swing one leg over top tire

Suggestions:

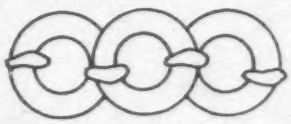
1. Units I and II can be used together as a routine with specific directions for continuous action from one unit to the next.

2. Use truck tires for larger unit of similar structure.

Unit III

Activity #1 (foreground)

Activities:

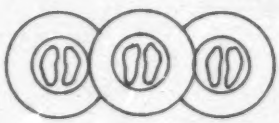


1. Have the child walk on the tire sidewalls across the center of the tire from left tire to middle tire to right tire in progression:

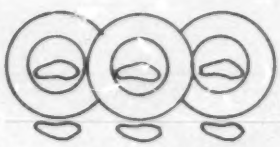
   a. forward stepping
   b. side stepping

2. Have the child:

   a. walk on side rims straddling tire center in same progression as activity #1 (left - middle - right)
   b. crawl - using hands and knees on or in tires.

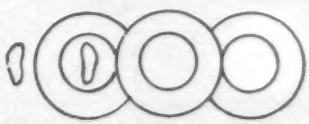


3. Place two feet inside each tire and side step from left to middle to right tire.



4. Have the child place one foot inside tire, other foot remaining on the ground outside tires - walk in progression from left to middle tire going:

   a. forward b. backward

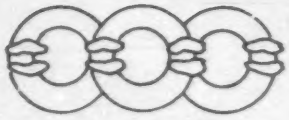


5. Pivot exercise

   a. Stand with right foot in tire and left foot out of tire as indicated.
   b. Pivot on right foot placing left foot in center tire.
   c. Pivot on left foot placing right foot in end tire.
   d. Pivot on right foot placing left foot outside tire.

6. Placing one foot inside left tire, hop on one foot to middle tire then to right tire:

   a. two foot jump in same progression.



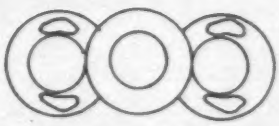
7. Placing two feet together on tire rims, junp to next tire in left - middle - right progression.

8. Have the child run and jump over the unit:

   a. lengthwise
   b. sideways

9. Have two chiidren face each other, one on left tire, one on right tire - walk to middle tire - grasp hands - drop hands, back off tire

10. Have two children stand back to back, feet on left tire rims - proceed sideways to middle tire and right tire while holding hands.



11. Have one child stand on left tire rims, one foot on each side, jump over middle tire to right tire.

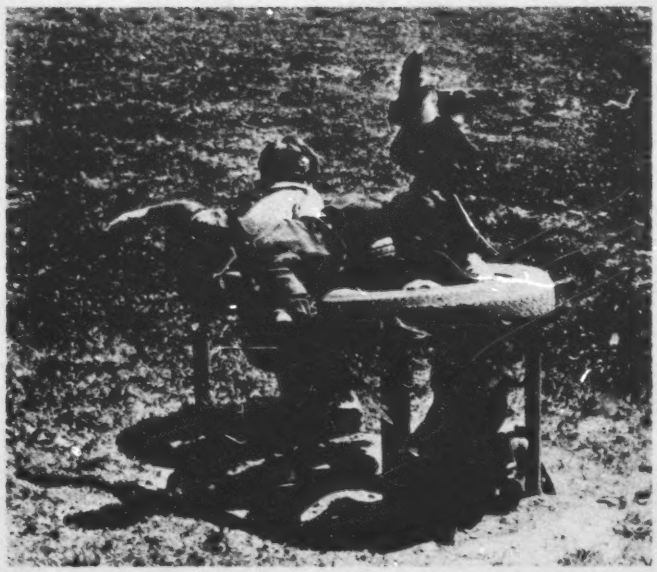
12. Have the child in same position as activity #11 - jump to middle tire and jump off without touching right tire.

13. Bounce ball in left tire, middle tire, and right tire. Throw bean bag in same progression for directionality.

Suggestion:

Children enjoy more complex directions with this unit.

Unit IV



Activities #1a and #3a

Activities:

1. a. Have the child crawl on hands and knees across tops of tires.

   b. Have the child walk - arms at sides - arms outstretched across the tops of tires.

2. With three people:

   a. Have each child find a specific colored tire and stand behind it:

      1) crawl up through tire
      2) climb down through the tire
      3) stand in tire
      4) change positions on tires.

3. a. Have a child lie on stomach across all three tires - balance arms outstretched.

   b. Have three people lie crosswise on tires - arms and legs outstretched - balance.

   c. Same activities only positioned on back.

4. a. Place two feet inside left tire - move to middle tire with two feet inside, and onto right tire with two feet inside.

   b. See page 3, Activity 5.

5. a. Have a child climb up through left tire head first, down through middle tire head first, and up through right tire head first.

   b. Have a child feet first in left tire - go down - then up through middle tire head first and down through right tire feet first. (in-out concept)

5. Have three people, one in each tire, listening to specific up-down directions. (Instructor calls out directional signals.)

7. a. Throw a ball into a specific colored tire.

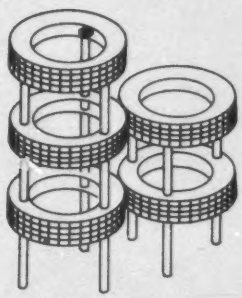
   b. Bounce ball on ground so that second bounce lands in tire.

Suggestions:

1. A new unit could be constructed by using four or more of this unit in a circle formation for additional activities.

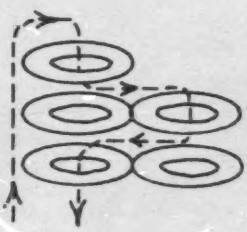
2. This unit lends itself to creative play (used as a train, bus, fort, etc.).

Unit V

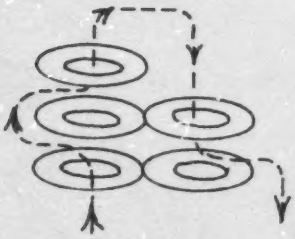


Activities:

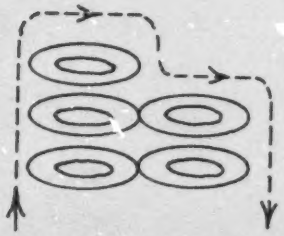
1. The child can climb up and down through the inside rims of the tire - both hands and feet are used.



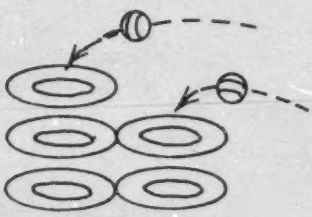
2. Have the child weave in climbing from side to side - both hands and feet are used.



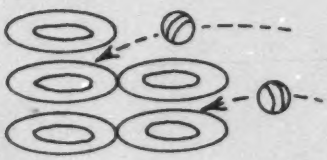
3. Have the child weave in climbing from inside rims to-outside rims going up and down - both hands and feet are used.



4. Have the child climb on the outside rims of the tires only - using both hands and feet.



5. Have the child throw ball down through tires.



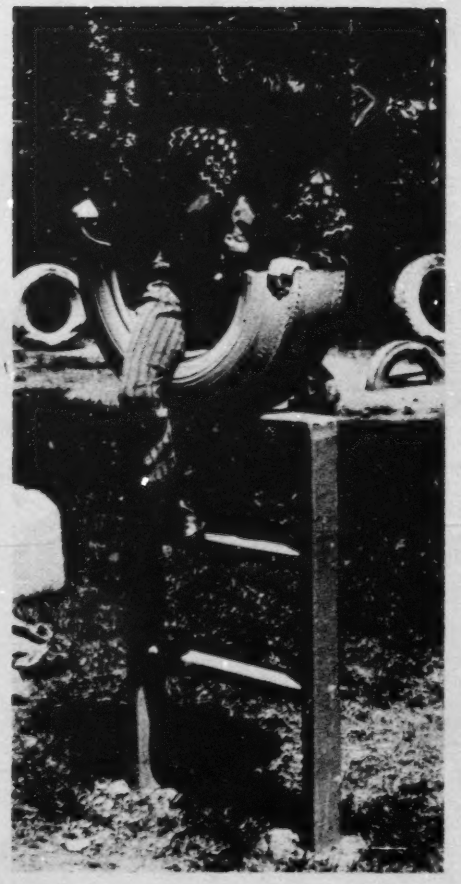
6. Have the child throw ball between specified colors.

Suggestions:

1. This unit lends itself to much imaginative play (children use this as a fort, tower, battle ship, etc.).

2. A limit of two people at a time for safety.

Units
VI and VII



Activity #2

Activities:

1. Have the child balance in a fixed position on second rung of ladder (feet on rung - arm extended).

2. Have child climb up and sit on inside of tire:

   a. hold on - feet free - arms and hands holding on tire
   b. not holding - feet free - arms extended.

3. Have child climb up one side, swing one leg over, then the other leg, and go down the other side.

4. Have the child throw a ball:

   a. through the space between the ladder rungs (bottom, middle, top)
   b. over the top of the tire.

5. Have the child throw a bean-bag so it will land inside the tire.

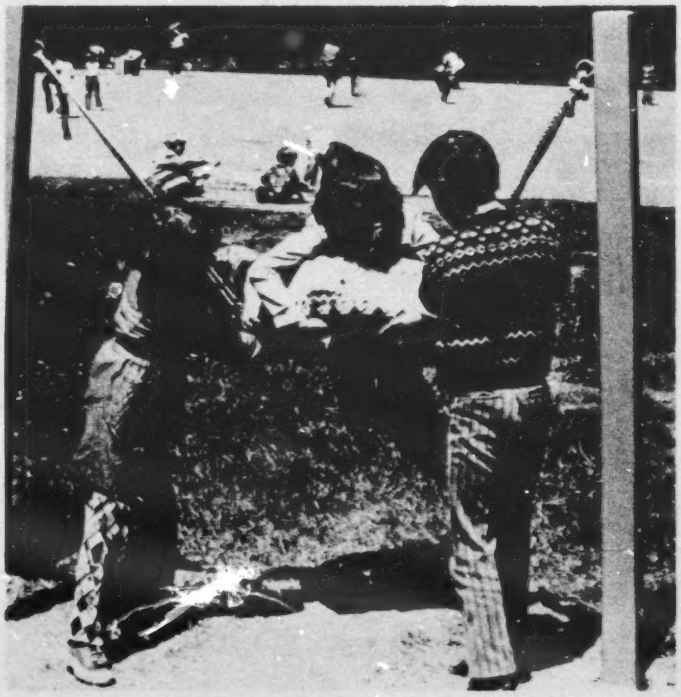
6. Have the child bounce a ball over the tire on the first bounce and then on the second bounce.

7. Have the child throw a ball to a person standing on the other side of the tire (so he can catch it).

Suggestion:

Special children enjoy using this unit as a horse (it gives added motivation for climbing).

Unit VIII



Activity #1

Activities:

1. Have the child sit in tire and swing - hands holding onto top of tire - feet and legs pumping.

2. Have the child swing on stomach - stomach resting on bottom inside rim, arms holding under bottom rim of tire, legs hanging.

3. Have the child balance on stomach - stomach resting on bottom inside rim, arms and feet outstretched.

4. Have the child throw a ball through:

   a. a stationary tire
   b. a moving tire.

5. Have the child throw ball over the tire to another person on the other side (so that he can catch it).

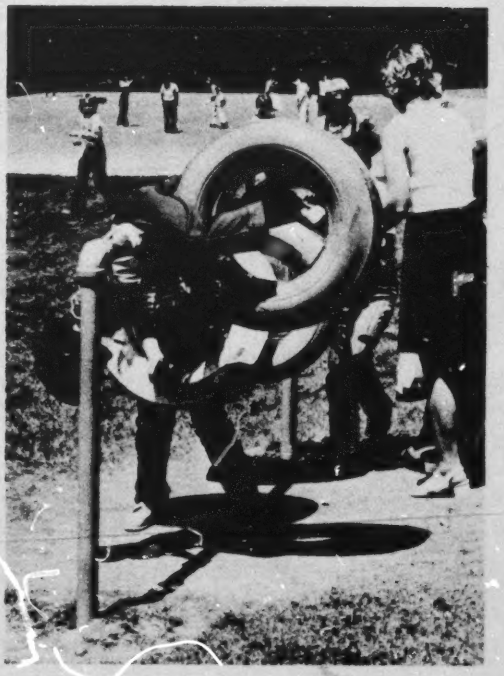
6. Have the child throw ball through the center of the tire to another person on the other side (so he can catch it).

7. Have the child bounce the ball before it goes over the tire.

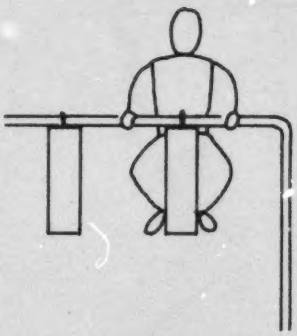
Suggestion:

An adult observer is advisable.

Unit IX



Activity #2a



Activities:

1. Have child put hands on bar (one on each side of hinge), pull up, and sit on top of tire with feet inside bottom of tire and hold position:

   a. on one tire
   b. on two tires moved together
   c. on three tires moved together.

2. Have child assume position #1 and rock the tire using both hands and feet to:

   a. make a rocking motion
   b. make a complete rotation.*

3. Use partners on tires - have two children face each other as in position #1 - swing gently (adult observer needed).

4. Have child climb through a tire- arms and head first, then whole body, and out the other side:

   a. with one tire
   b. with two tires moved together
   c. with three tires moved together.

* It is possible for a child to make a complete rotation around the bar, but this should be done under the supervision of two adults.

5. Slide three tires together to form a tunnel; have child balance body inside all three tires:

   a. lie on stomach
   b. lie on back
   c. change from one position to another
   d. gently rock tunnel in a, b, or c position.

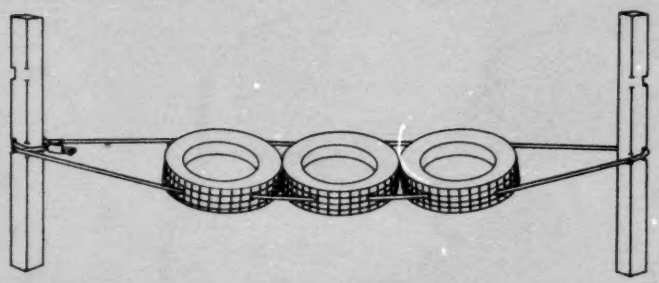
6. Have child climb from one tire to another - keeping hands on bar - moving feet from one tire to another.

7. Have child swing from bottom of tire - hands and feet both hanging on inside bottom rim of tire.

8. Have child throw a bean bag through:

   a. one tire
   b. two tires together
   c. three tires together.

Unit X



Activities:

1. a. Have the child lie crosswise on the tires, arms outstretched, and swing, using feet to "pump" (on stomach or back).
   b. Have child lie lengthwise on tires, arms outstretched and use body to cause a swinging motion (on stomach or back).
   c. Both a. and b. may be done with the child holding onto the tire with his hands.

2. If the unit is low enough, have the child step through the tires without touching the sides of the tires with his hands or feet.

3. Have three children sit:

   a. feet down, outside the rim, hands holding onto tire and swing
   b. feet down, inside the rim, hands holding onto tire and swing.

4. Have child walk on rims of tires (while holding adult's hand):

   a. on outer edge of tires
   b. on midline
   c. on the perimeter of tires - left, right, and criss-cross.

5. Have child snake weave through the tires - down through the left tire, up through the middle tire head first, and down through the right tire head first.

   a. This could also be done feet first down through the end tire, up head first through the middle tire, and down through the other end tire. Verbal directions should be given continuously as the child performs the activity until some success has been achieved. Directions could then be given all at once to extend listening and memory skills.

6. One child at a time can throw a ball through the center of the tires:

   a. while tires are stationary
   b. while tires are swinging
   c. specific colors can be directed to continue color recognition.

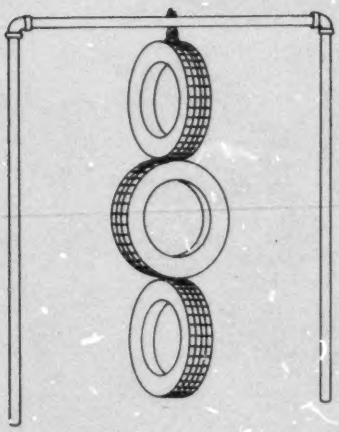
7. One child can bounce a ball through a tire for a partner on the other side to catch.

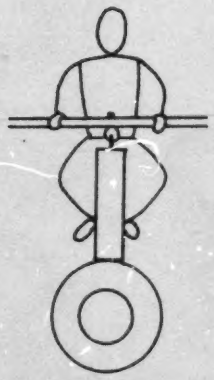
8. Have child bounce and catch a ball upon verbal commands, by a helper, using color recognition as commands. For example; "Bounce the ball through the red tire and catch it," or, "Bounce the ball through the green tire and catch it."

Suggestion:

The children are easily attracted to this unit as it can be used by as many as three at a time in free play. They use it together, being both dependent on others on the unit for its movement and gaining in social skills of playing together, manners, etc. The child or children on the unit should provide the motion for it themselves as it is UNSAFE to have other children standing on the ground pushing it.

Unit XI





#6 Below

Activities:

1. Have the child climb through the bottom tire:

   a. head first using hands to assist in getting through
   b. feet first - it is necessary to hold onto tire with his hands as tire moves easily.

2. Assist one child in climbing like a snake through the unit - head first through the bottom tire, climb up to the middle tire, go through it, and on up to the top tire and through it and weave in similar manner back down.

3. Have one child climb to top and sit in it while another child climbs to middle tire, sits in it, and a third child climbs into botton tire and sits. Together they can pump with their feet (holding on with hands) to cause the tires to swing.*

4. Have one child climb to top tire, hold onto it with his hands, and dangle his feet performing a hand swing.

   a. This may be repeated and done from the middle tire also.

5. Have two children sit in opposite sides of bottom or middle tire, holding on with hands, and swing.*

6. Have a child climb to the top tire, place feet inside and stand (see drawing).

   a. Balance, holding on to top bar (adult observer should be present).

*This can be done only if the bottom tire is not anchored.

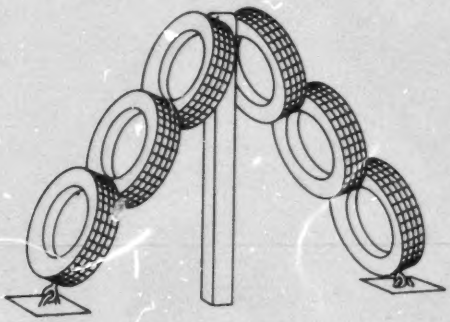
7. Have one child throw a ball through the bottom tire to a partner on the other side. This same feat could be attempted by taller children using middle and top tires:

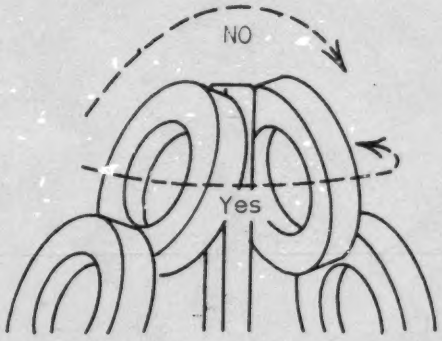
   a. while tires are stationary
   b. while tires are swinging.*

Suggestions:

Caution is required when more than one child is climbing on the unit. This unit can be used to reinforce color recognition; concepts of top, middle, and bottom; and social skills.

Unit XII





#2 Below

Activities:

1. Have child climb a ladder using hands to grip with and descend the same ladder after reaching the top:

   a. using feet
   b. using knees
   c. using combination of knees and feet
   d. facing the pole
   e. back to the pole.

2. After a child has successfully climbed the ladder, have him climb to the top tire of one ladder, step over to the other ladder (see drawing) and climb down. (An adult supervisor is necessary for this activity.)

   a. Use same sequence of skills as in #1, but have child face tires when first attempting to climb down.

3. Have child climb to a tire that is a specified color and then jump to the ground:

   a. free jump (no hands)
   b. hanging jump (hold on with hands and then let go).

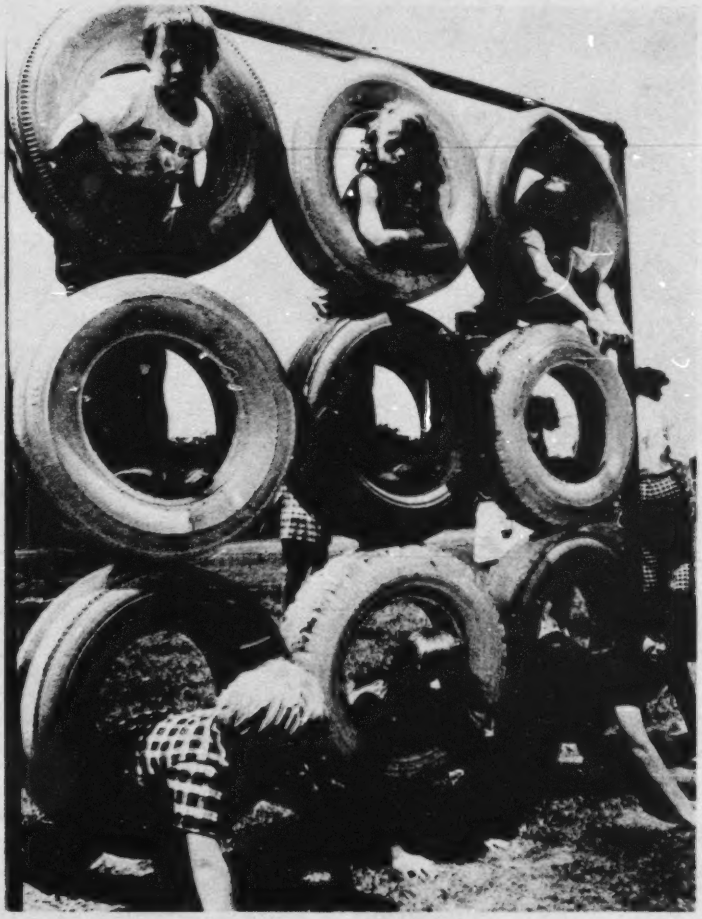
4. Have child throw a ball or bean bag through a specific colored tire.

Suggestion:

This unit is appropriate for one child at a time on each ladder.

* This can be done only if the bottom tire is not anchored.

Unit XIII



Courtesy of Knickerbocker News

Activities:

1. Have the child climb using hands and feet with specific directions from teacher or helper as to which color tire to climb to next (i.e., blue, red, blue) on the way up and use yellow tires only on the way down.

2. Have the child climb up, throw one leg over the top while holding on with hands, bring other leg over, and climb down other side. (A spotter is necessary for this activity.)

3. Have the child climb up - climb down, with directional commands:

   a. vertical with both feet in the same tire
   b. horizontal holding on with his hands
   c. diagonal.

4. Have a child climb up placing his feet:

   a. inside the tire rims
   b. on outside of tires
   c. any combination of a. and b.

5. A child may be asked to crawl through any one of the bottom row of tires touching the tire as little as possible:

   a. head first
   b. feet first.

6. Have a child put his head, shoulders, and arms through any given tire, outstretch his arms, and balance (a spotter is required for this activity).

7. Have a child straddle balance inside a tire (small children only).

8. Have a child climb using two adjacent vertical rows placing one foot in each row as he climbs and holds on with his hands.

9. A child may do a snake weave climbing on this unit, climbing in and out and around in several directions; i.e., up, down, across, diagonal, etc.

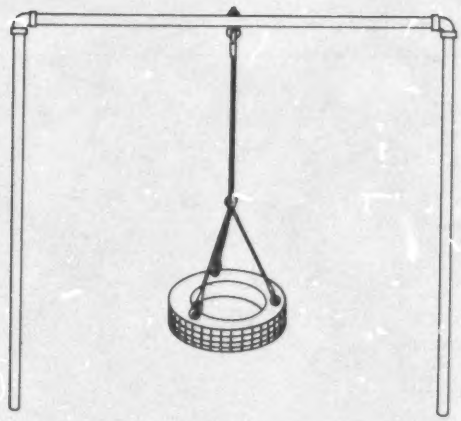
10. Ball activities may consist of throwing a ball through:

    a. a specific color or colors
    b. the free space
    c. without hitting the tire
    d. to a partner on the opposite side.

Suggestion:

If numbers are attached (taped) to the tires in sequence across bottom row and up, additional activities would ensue involving number recognition.

Unit XIV



Activities:

1. Have one to three children sit in tire, feet inside with hands on ropes, and swing, pumping with feet and pulling with arms.

2. While children are sitting in tire, another person can help them to twist the rope and then move back while swing unwinds and spins.

3. Have a child lie across the tire, arms outstretched and balance:

   a. still balance
   b. free balance (moving).

4. Have one or two children stand with feet on tire, holding onto rope and swing by bending knees to start the motion. (A spotter is advisable.)

5. Have a child hold on to the tire with his hands only, feet dangling on outside, and swing.

6. Balls or bean bags may be thrown through the tire while the tire is:

   a. stationary
   b. moving.

Suggestion:

To do Activity 5, adequate clearance from the ground is necessary.

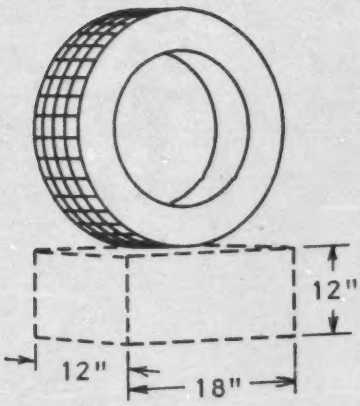
PART II

CONSTRUCTION AND INSTALLATION

CONSTRUCTION AND INSTALLATION

Some things to be considered:

- All paint MUST be lead free (acrylic latex is suggested).
- MINIMUM rope size is 3/8" braided nylon line (or something equivalent) with a WORKING (not tensile) strength of 500 pounds.
- Dimensions not shown will depend on the size of the tires used which, in turn, will be determined by the size of the children who will be playing on the units.
- Wooden blocks to be used inside the tires should be made of a hardwood (oak, hickory, maple, etc.) if possible and treated with a wood preservative (not creosote).
- In some instances, 2" pipe may be substituted for 2" X 4" or 4" X 4" lumber.
- Cover all concrete footings with 2 inches of soil or sod.
- Galvanized thimbles should be used where line is attached to an eye to keep the line from chaffing.
- Plastic electricians' tape should be used where tape is specified.
- Footing sizes will depend on soil structure and size of tires.
- Use tree limbs where and when applicable
- When possible, tires with firm sidewalls should be used.
- To prevent nuts from loosening after they have been tightened, use a cold chisel to dent the threads of the bolts as close to the nut as possible.



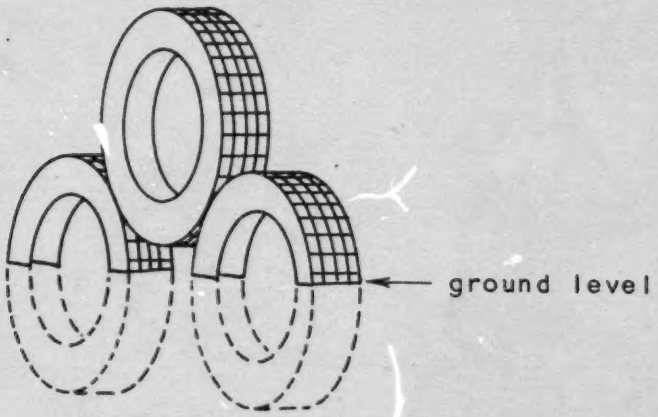
UNIT I

In the Shop

Select a painted tire and drill a 1/2" hole through the center of the tread area. Insert either a 1/2" x 5 1/2" bolt to anchor in concrete or a 1/2" x 4" lag screw to anchor the unit to a buried log. The anchor log should be drilled in the center of one end with a 3/8" spade bit. (See drawings, Method A and B page 47.)

At the Site

Dig a hole for cement or dig a post hole for the log at the determined site for the unit. Install the anchor log in the post hole and tamp the earth around the log firmly with a large sledge hammer or something similar. Use construction Method A to attach the tire to the anchor log. A ratchet wrench may be used to turn down the lag screw into the hole in the log. If concrete is used to anchor the tire, collect sand, water, aggregate and portland cement in correct amounts, and after mixing, fill the excavation with the concrete. When the concrete has hardened, remove the nut and the block and fasten the tire to the footing using Construction Method B. Note that the tire is in the proper orientation.



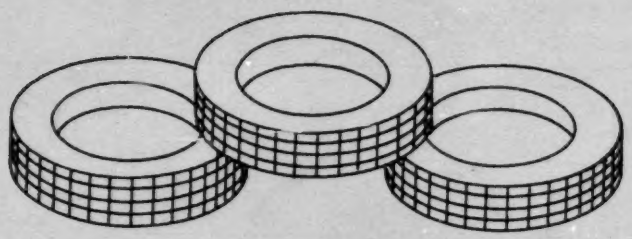
Unit II

In the Shop

Select three tires of different colors and lay them on a flat surface in a position to form a triangle. Separate the two base tires about 12" apart. With the tires in this position determine the contact points of the three tires. Holding the tires firmly in this position, drill 1/2" holes through the tires at their point of contact using an electric hand drill and a 1/2" spade bit. Connect the three tires using Construction Method C (page 48). A "weep" or drain hole should be drilled in the bottom of the upper tire using the same drill and bit. Weep holes are necessary to prevent the tire from filling with rain water.

At the Site

Determine, from the plot plan, the position of the unit and its orientation. Masons' line, 6' rules, and steel tapes can be used to determine the unit's position on the field. Dig a hole large enough in size and properly oriented to accommodate the bottom halves of the two base tires. Place the unit in the hole and bury the bottom halves until the hole is filled to ground level. Care must be taken in tamping the soil firmly around the tires in a manner that will not distort the shape of the buried tires.



UNIT III

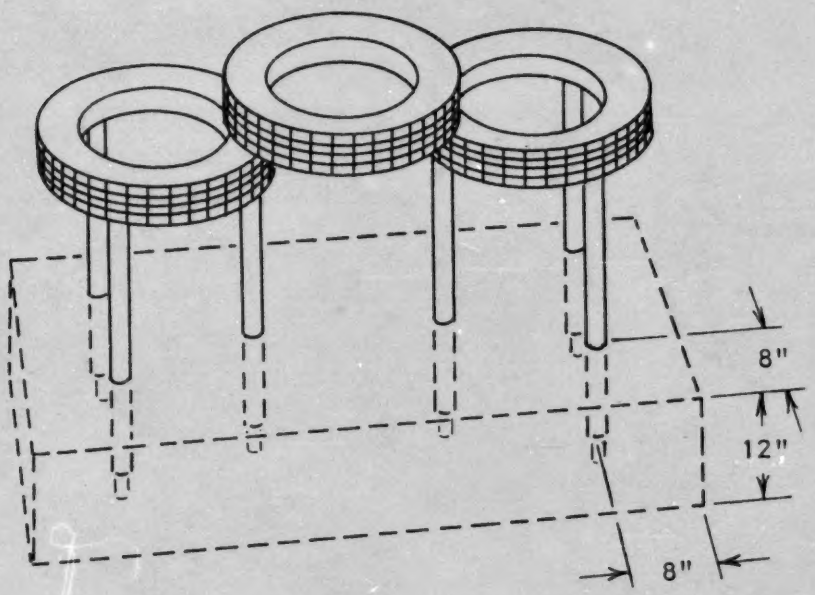
In the Shop

Select three tires of different colors and determine the line through the center or the diameter line of the tires. This can easily be accomplished by laying the tires flat on the floor, lined up against a wall of the shop. Place a 2" x 6" piece of lumber on edge against the treads of the three tires and measure the distance between the wall and the inner edge of the 2" x 4". Half of this measurement is used to determine a line parallel with the wall and marked across the sidewalls of the three tires. This is the center line of the three tires and the line through which the holes for assembling should be drilled. Choose one tire as the top tire of the unit. Determine the center of each sidewall along the diameter line. This same measuring procedure can be used to determine the position of the hole in ONE SIDEWALL of each bottom tire in the unit. Use a 1/2" spade bit in an electric hand drill to make these holes and then connect the three tires using Construction Method C (page 48). Put the three connected tires upside down on the floor against a wall and again determine and mark the center line of the unit parallel to the wall on the under side of the connected tires. In the center of each of these lines (4) drill 1/2" assembly holes. Halfway between the 1/2" holes and in the center of the sidewall area, 1" weep holes should be drilled. Also drill weep holes in the underside of the top tire half way between the contact points of the tires.

At the Site

Use the plot plan and measuring tools to determine the placement and orientation of this unit. Post hole diggers are used to dig holes that are in alignment and have center measurements which correspond to the four 1/2" holes in the underside of the two bottom tires. After the post holes have been dug, insert 4 anchor logs about 24" long, replace the soil and tamp firmly. Care must be taken to make sure that the tops of the logs are level with each other and flush with the grade level. Place the connected tires over the anchor logs, positioning them so that the assembly holes are near the centers of the logs. Mark the logs through the 1/2" holes in the tires. Remove the tires and drill 3/8" x 5" deep holes in the logs using a 3/8" auger bit and a hand brace. The unit can then be secured in position using Construction Method A (page 47).

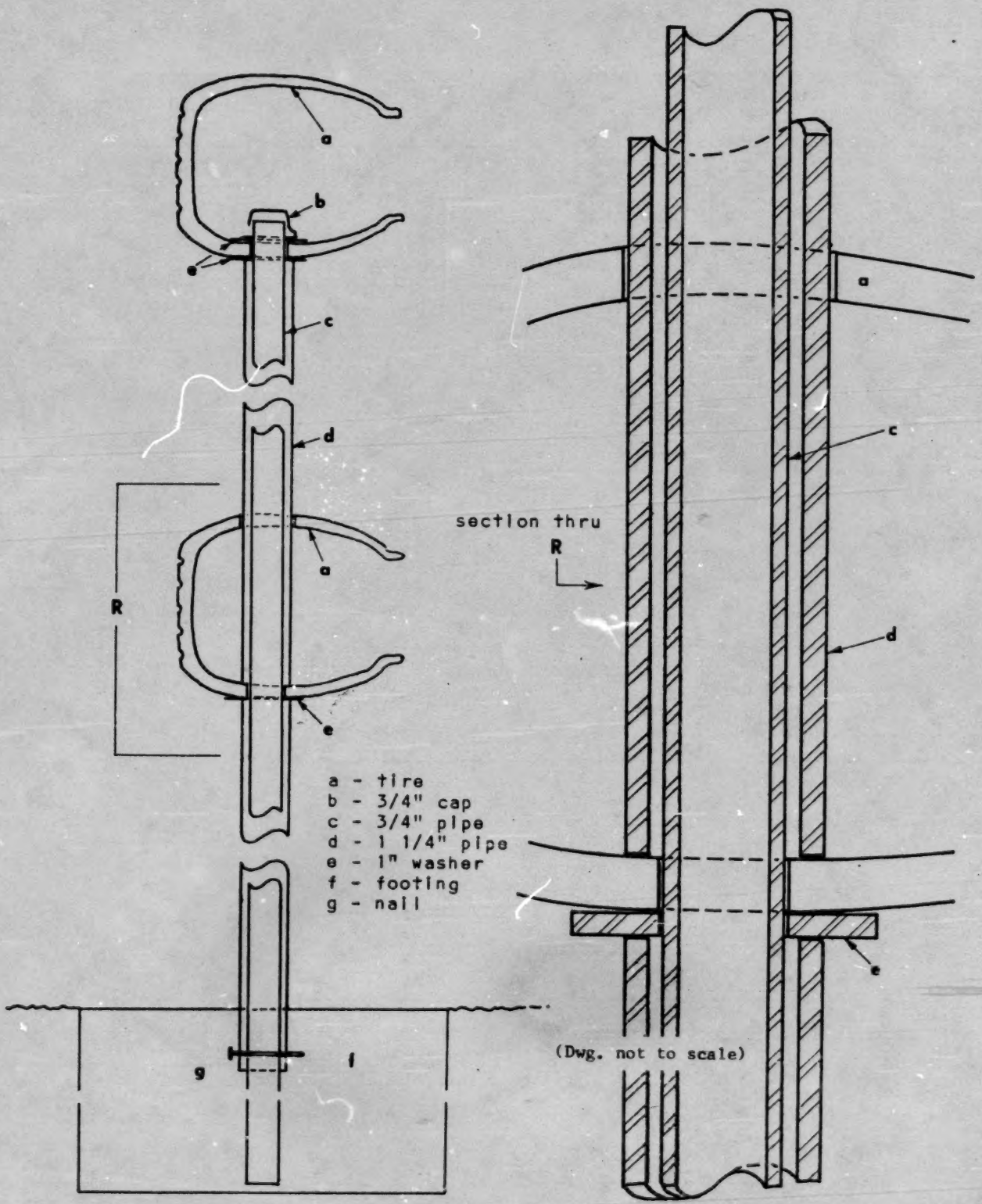
students painting primer coat on tires



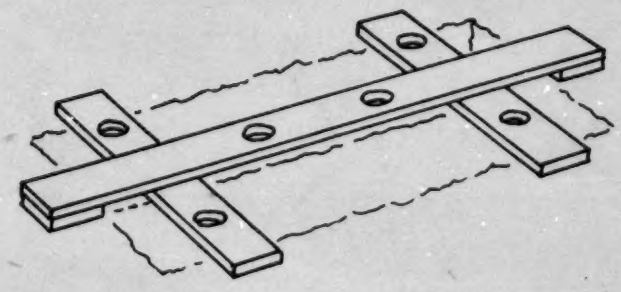
UNIT IV

In the Shop

Select three tires having the same diameter and of different colors. The first steps are the same as those used in Unit III up to and including the method of marking the center line on the underside of the bottom tires. Use a 1 1/8" spade bit to drill holes in the underside of the bottom tires at the point in the line where the inner support legs are to be attached. The holes for the outer support legs are drilled the same size at exactly 120° around the tire in each direction from the first hole. Three additional smaller holes are then drilled in the same sidewalls of each tire, half-way between the 1 1/8" assembly holes (to allow for drainage). Students building this unit should alternate with other students using plumbing tools and other equipment in the shop to cut, ream, thread, and prepare the pipe sections necessary for their unit. The students should use tools and methods determined by their instructor to be related to each student's ability. Both hand tools and electrical machines are used in the plumbing operations undertaken. The pipe construction for this unit is illustrated in the cutaway drawing on page 26 and is actually the same as the top section of Unit V. The inside pipe should extend below the outside pipe, and after assembling, both should be drilled and pinned as shown at the bottom of the


a
b
c
d
a
R
e
section thru
R
a
c
d
e
a - tire
b - 3/4" cap
c - 3/4" pipe
d - 1 1/4" pipe
e - 1" washer
f - footing
g - nail
g
f
(Dwg. not to scale)

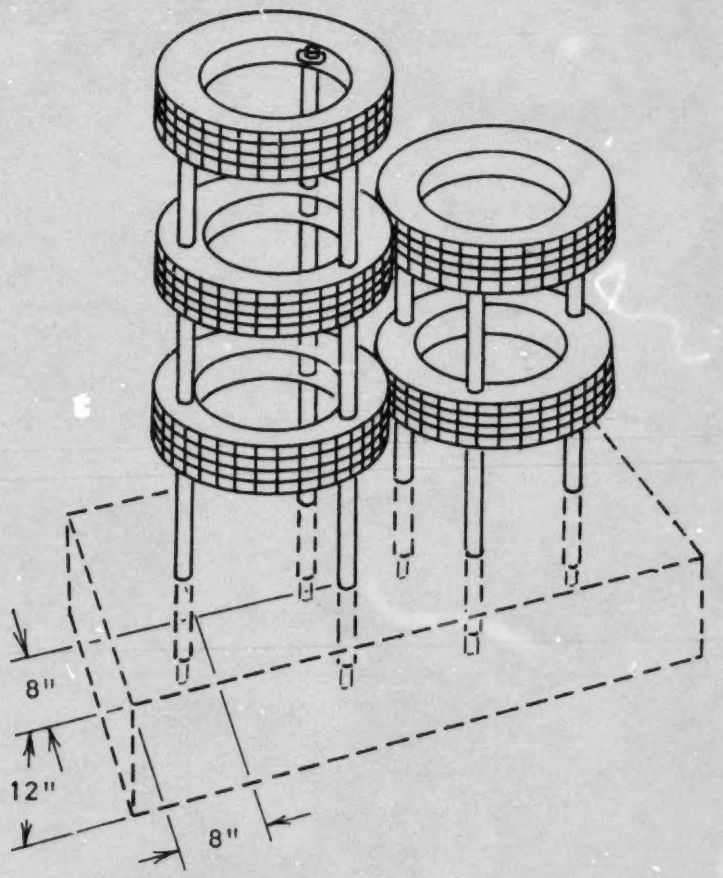
drawing. A one-inch flat washer must be centered and welded to one end of each of the 1 1/4" pipes. This can be done by students at an auto body shop. (If no 1" washers are available, scrap iron can be torch cut and will serve the same purpose.) All pipe, especially old rusty pieces, must be ground and sanded by hand, and with electric disk sanders. These can then be painted with two coats of O.D. lacquer purchased at an Army surplus depot. The Army surplus paint is not only very inexpensive, but completely satisfactory in color, texture, and durability. The last preparation necessary in the shop before the unit is ready for the site is to build a jig for holding the unit rigid and in proper alignment while the concrete base that holds it becomes hardened. One method, tried successfully, is to build a frame of 1" x 4" lumber large enough to span the excavation and with the boards positioned so that they allow for 1 7/8" holes to be drilled in the same relative positions as the assembly holes in the underside of the bottom tires. (See sketch below.)



Mark the alignment of the 1 7/8" on the frame by positioning the connected tires right side up on the frame and marking through the assembly holes. Drill the holes with an expansion bit and a hand brace or use a coping saw. Assemble the legs to the tires and set the unit into the frame to check alignment (as shown in the drawing).

At the Site

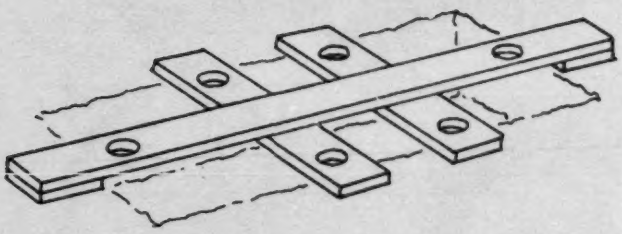
Determine the placement and orientation of the unit as in previous units and prepare the excavation. Transport the connected tires, all pipes, and the frame to the site, and reassemble it (having been taken apart for ease in transportation). At its location, the complete unit is placed over the excavation by the students. Leveling is achieved by using a 24" level. Install the concrete base in the same manner used for Unit I. It should be noted at this time that the students will find it much easier to collect large rocks, broken cement blocks, and the like to use as aggregate for the concrete than it would be to hand mix the complete cubic footage of sand and pea stone. By doing this, the consumption of cement is cut in half. (Considerable skill will be developed in the handling of filled wheelbarrows in the accumulation of the aggregate from the surrounding area.) Before students leave this unit it must be stayed firmly in a vertical position while the concrete hardens. This is accomplished by inserting one end of a 10-foot long 2" X 4" into the open side of the tires and nailing it securely to a wooden stake driven into the earth at the other end of the 2" x 4". Three or four braces of this type are needed in various directions in order to stay this unit in its proper vertical position. The concrete slab must be sprinkled with water for a few days particularly if it is in the hot sun. When the slab has hardened, the frame can be cut away from the unit, and the students can cover the surface with some of the soil that was removed from the excavation or some sod.



UNIT V

In the Shop

Select five previously painted tires (three with 15" rims and two with 14") for this unit. Selecting one of each size, find the diameter lines using the same method as used in Unit IV. Align the two tires (14" and 15" rims) using the diameter line as a guide and butt the two together. At the point of contact, drill a 1/2" hole through both tires and connect them using Construction Method C (page 48). Determine the center of that portion of the diameter lines on the sidewalls of each tire, in the line farthest from the contact point. When this point has been determined proceed as in Unit IV and mark those positions 120° on each side of the first hole. These holes are then drilled with a 1 1/8" spade bit. Weep holes are drilled half way between assembly holes. All six 1 1/8" holes are in the underside of each of the connected tires. Construct a wooden frame as shown on the following page.



Place the connected tires, holes down, on the frame and mark through the assembly holes on to the boards denoting the position of the 1 7/8" holes to be drilled in the frame. Drill these holes vertically through the boards. The frame, when drilled for the outer legs (1 7/8" holes), is then set aside until all the holes in all the tires for this unit have been drilled. Find the centers of the 1 3/4" holes (which must be cut exactly perpendicular to the assembly holes in the underside of the bottom pair of connected tires) by laying the connected tires upside down on the floor. Determine the approximate center of the hole in the opposite sidewall and drive an 8" x 1/4" drift punch through the rubber of the opposite sidewall. The painted surface on the face side of the tire will be scarred, indicating the center of the opposite set of holes. Use a 1 3/4" hole saw in an electric hand drill to cut out the assembly holes from the top face of the tires. The scar left by the drift punch is used as the pilot hole for the hole saw. Next connect two tires (14" and 15" rims) to form the second tier, using Construction Method C (page 48). Place the connected tires of the second tier upside down on the floor and position the connected and drilled tires of the first tier upside down on top of the second tier, as perfectly aligned with the second tier as is possible. Scribe the circles of the 1 3/4" holes of the first tier on the underside of the second tier tires, thus locating the positions for the 1 1/8" assembly holes. After the 1 1/8" assembly holes are drilled, weep holes are drilled between each of them on the same side of the tire. Use the method just described to determine the position of the assembly holes in the top side of the tire that is to receive the third tier of this unit.

At the Site

Use the same methods and tools as were used for Unit IV to install this unit.

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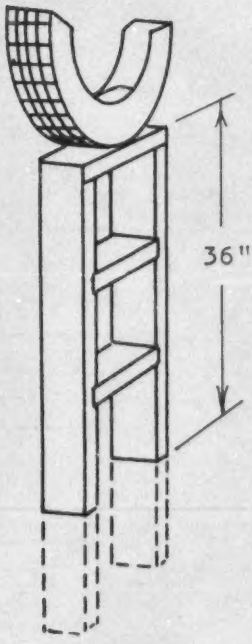
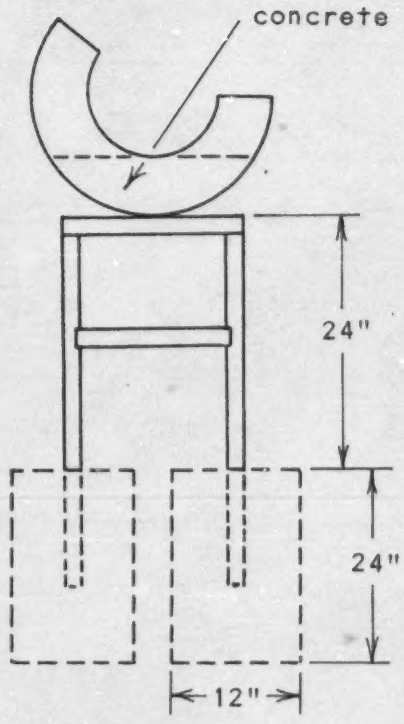




UNITS VI and VII

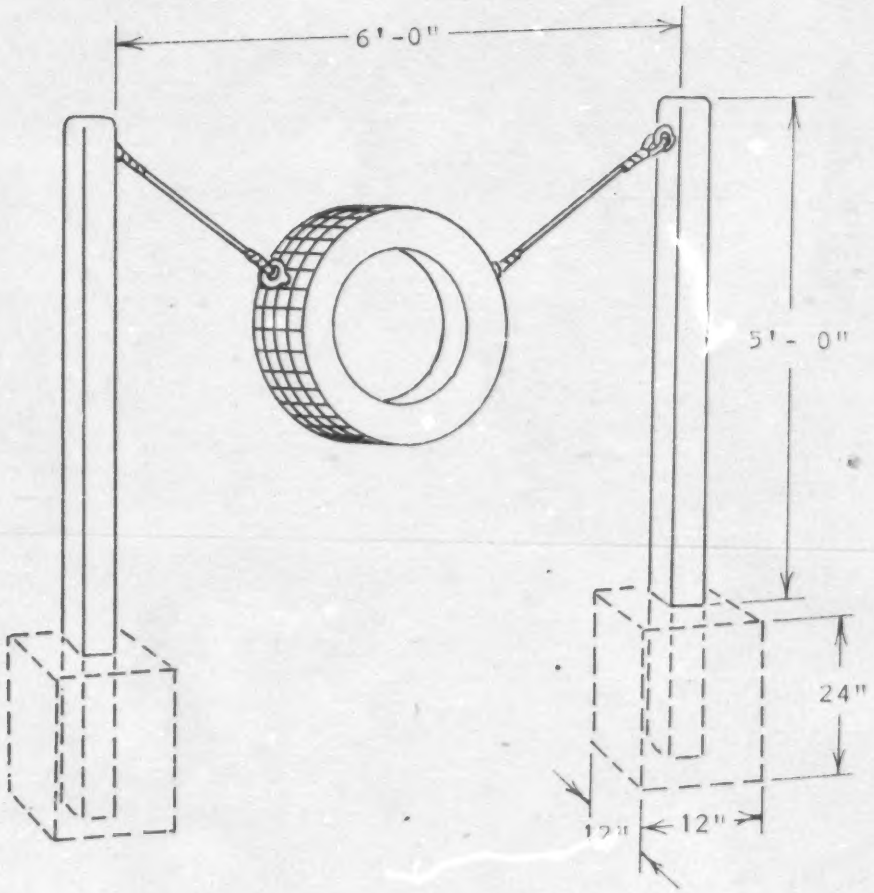
In the Shop

Two students, each having chosen either Unit VI or VII as his project, should select a cleaned but unpainted tire that has firm sidewalls. Measure out an arc of 220° on the circumference of the tire. This can be done by finding the diameter line as in Unit III and adding 40° using a protractor. Mark this line across the sidewall of each tire. Use a sharp 10-point crosscut saw to cut squarely through the tires on the lines determing 220° of the circumference. When the saw reaches the inner rim of the tire, a hack saw must be used to cut the cables in this part of the tire. The ends of these cables should be filed smooth and covered with a dab of plastic rubber so that children playing on the unit will not injure themselves on the cut ends. Set the section of the tire to be used on its tread on a flat surface and determine its point of contact with the surface when one of the cuts is parallel to that surface. At this point and in the center of the tire tread, drill a 1/2" hole using the same tools and methods that

were used in preceeding units. The tire sections are now primed and painted with the color of choice. The frames of these units should now be made using the measurements specified in the diagrams for the units. The length of the steps will be determined by the depth of the rabbet in the legs. Cut the outer edges of the rabbet with a 10-point crosscut saw to a depth of 1/2" or 3/4". Two or three cuts of the same depth will allow the students to clean the rabbet out with a wood chisel and a hammer. Nose and sand all members of the units in preparation for assembling and painting. When the previous steps have been completed satisfactorily, assemble the legs and steps first, using both white glue and 3" wood screws to connect the pieces. Measure the width of the unit and cut the top 2" x 4" to fit. This should also be glued and screwed in place. Care should be taken to assure a squared unit when finished. (Pilot holes, of a smaller diameter than the screws to be used, should be drilled through both members that are to be connected. The hole in the primary member should then be enlarged to the same diameter as the shank of the screw.) Prime and paint the frames. When the frames have dried, determine the center of the top step by drawing diagonals from the corners. At the intersection of the diagonals drill a 1/2" hole and, using Construction Method E (page 49), anchor the tire sections to the frame.

At the Site

Determine the location and orientation of the units using tools and methods described for other units. The post holes should be dug to allow a minimum of 24" of the 2" x 4" legs to be inserted in the ground. Drive a few 1 1/2" roofing nails into each 4" face of the legs up to a point that is 20" from the bottom of each leg. These nails are placed in random positions with their heads protruding about 1/2" from the face of the legs. This allows for more secure anchorage when the concrete is poured into the post holes and hardens. A few large stones can be used to wedge the legs securely into the proper level and plumb position before the concrete is poured. The last step is to fill the bottom hollow of each tire section with concrete, to a level even with the top of the inner rim, and to smooth the surface to eliminate the possibility of children scraping themselves.



UNIT VIII

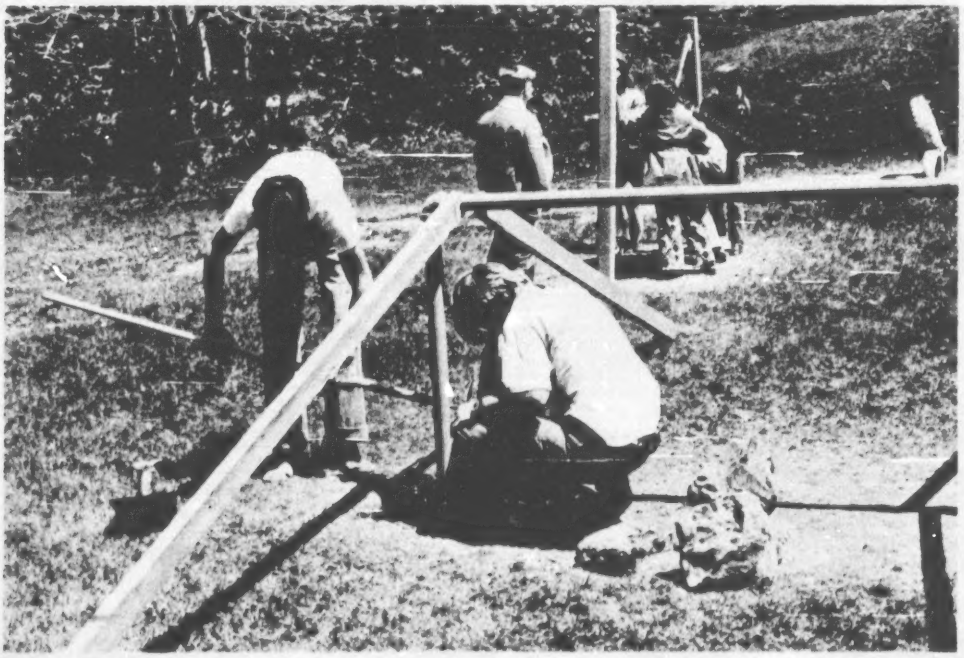
In the Shop

Prepare the 4" x 4" posts by cutting them to the specified lengths, nosing, sanding, priming, and painting them. Only lead-free paint must be used. Cut the nylon line into approximately 66" lengths.(This can be done by having one student hold the line taut, while another burns through it with a propane torch. This method of cutting the line melts the end and prevents it from fraying.) In a primed and painted tire, drill two 1/2" holes 24" apart on the circumference of the tire and in the center of the width of the tread. Insert 1/2" eye bolts and secure, using Construction Method F (page 49). Drill and anchor a 4" x 1/2" screw eye to the 4" x 4" posts about 3" from the top of each post. Drive 1 1/2" roofing nails into the posts in the same manner described for Units VI and VII. Attach a length of nylon line to each of the screw eyes, using Construction Method H (page 50). Lay the unit on the floor (tire, post, and line), and square it up as it will be at the site. Determine the height of the tire from ground level, put the thimbles through

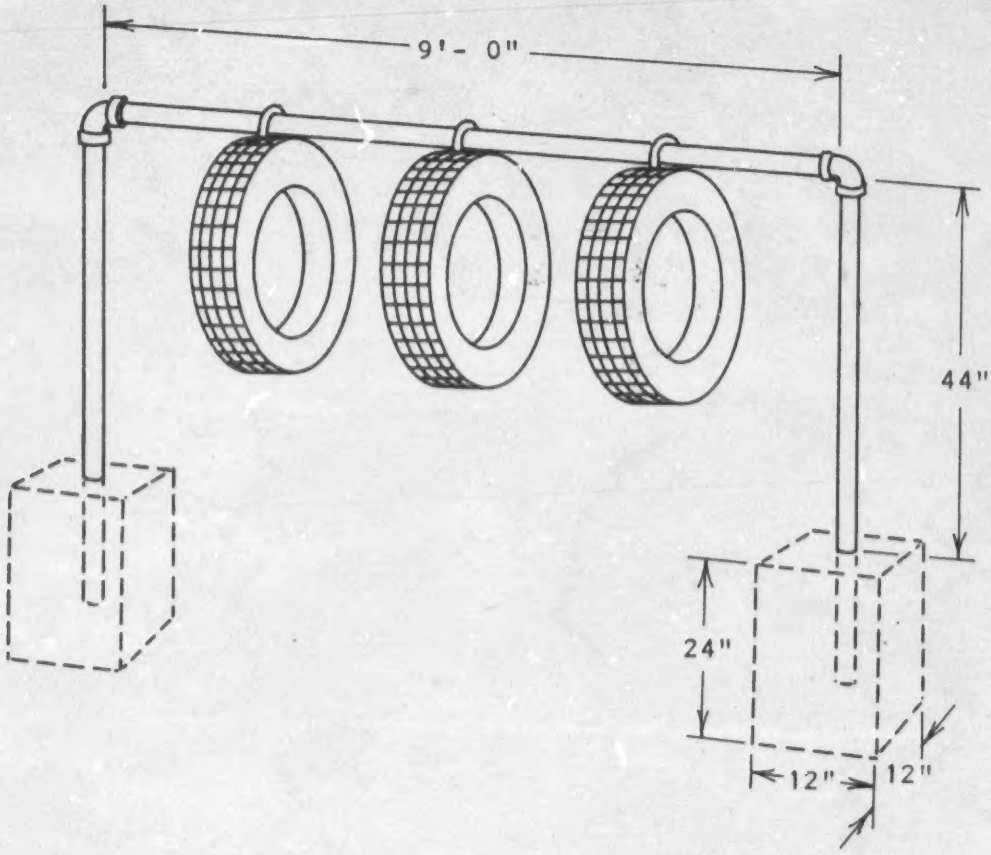
the eye bolts and loop the line around the thimbles. Judge how much line will be required and cut off any excess with a torch. (Construction Method F will be used at the site again.)

At the Site

Follow the same procedure that was used for Unit III to locate, orient and excavate the two post holes, using measurements shown in the drawing. The posts for the unit should be placed in the post holes so that the screw eyes face toward the center where the tire will be hung. They can be leveled by using a 4' mason's level and a straight edge across the top of the posts. Small stones of a proper thickness may be used under the posts to bring them to a level position. When each post has been secured in a plumb position by wedging rocks in the post hole (near the top), mix a "soupy" batch of concrete and pour it into the hole. Puddling the mix in the hole with a thin stick is necessary to assure a good grip around the nail heads. After the concrete has hardened and the posts are firmly anchored, have two students hold the tire while others attach the nylon lines to the eye bolts, by again using Construction Method H (page 50).



students installing Unit IX (note method of bracing and size of aggregate being used)



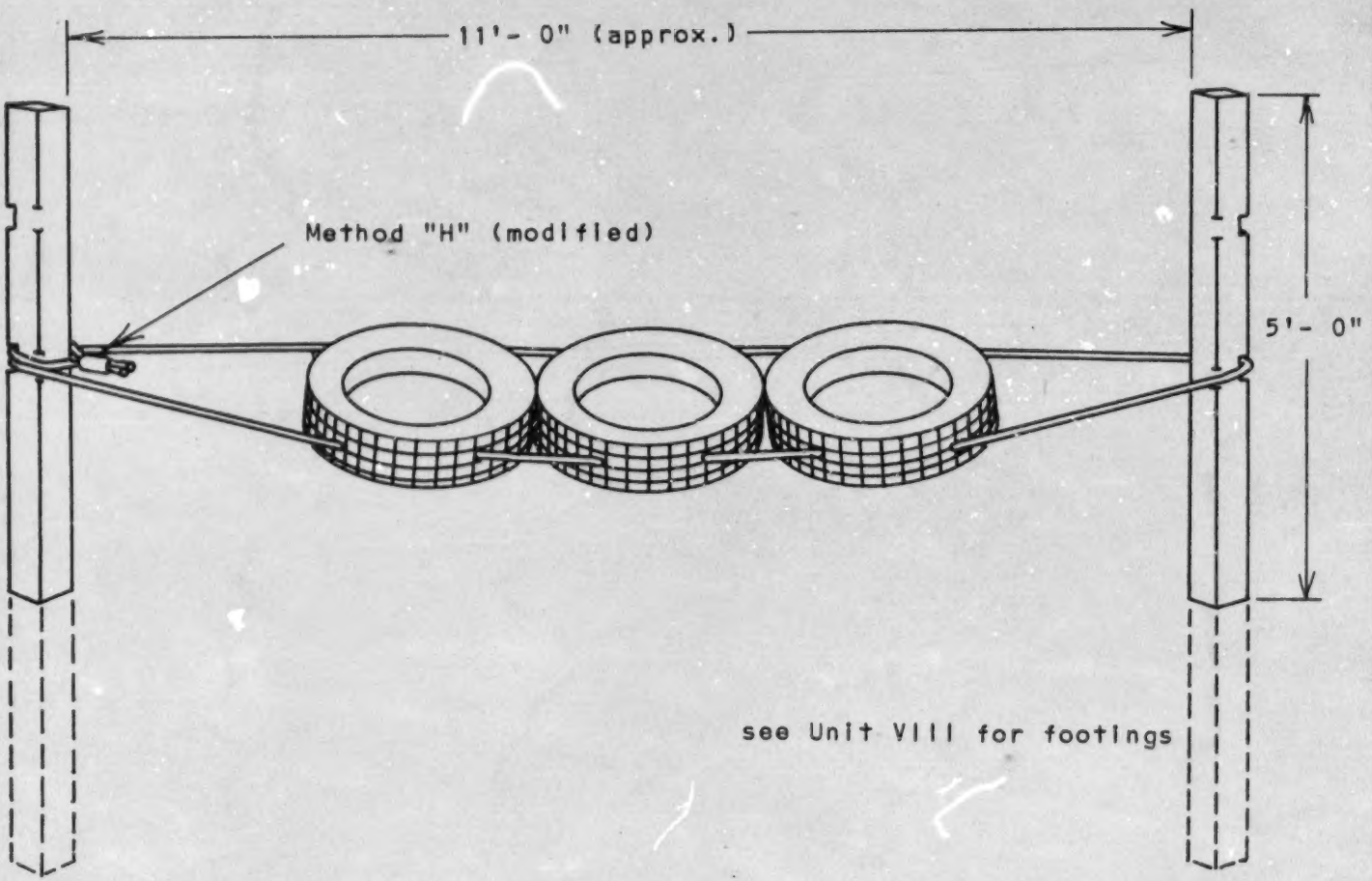
UNIT IX

In the Shop

Choose three 15" tires, and using a 3/8" U-bolt and the center line of the tread area, locate and drill 3/8" assembly holes with a spade bit and an electric hand drill. Weep holes are then drilled with a 1" spade bit 180° from the top assembly holes. The tires may now be primed and painted different colors. While the tires are drying, see the drawing for this unit to determine the sizes and length of pipe needed and proceed with the assembly as diagrammed. When the pieces of pipe are finished, the 2" elbows are screwed on to each end of the top pipe. They should be tightened to a position that would put the two legs in a parallel position when they are screwed into the remaining opening in the elbows. Screw the leg pieces into the elbows and tighten them. The pipe frame can be clamped to one leg of a workbench so that the students can continue with the assembly of the unit. Choose three undrilled 2" x 4" blocks and determine the longitudinal center line of each block. Locate and drill two 3/8" holes in each block to accommodate the shanks of the U-bolts. Use Construction Method G (page 50) to hang the tires to the top rail.

At the Site

With the tools and methods used for Unit II, locate and orient the positions for the legs of the unit in the playground area. The excavations for the bases should then be dug, using the measurements specified in the drawing for this unit. The more advanced students may now be instructed in the setting up and leveling of a builders' transit and the proper adjustments required to sight through it. Instruction in the use of the rod and target in conjunction with the transit, to level blocks in the bottoms of the excavations, can be done at this time. Half a termite block can be used under each leg of the pipe frame to keep it from sinking into the soil while the concrete work is being done. These blocks must be leveled at the proper depth by means of the transit. After setting the termite blocks, plumb the unit with a 4' level and use 2" x 4" lumber to secure the unit as was done with Unit IV. Mix and pour the concrete, adding pieces of aggregate as the holes are filled. Puddle the mixture thoroughly while this is being done. When the concrete has hardened, re-hang the tires on the rail (they would probably have been removed for ease in transporting the unit). Cover the bases with soil and/or sod.



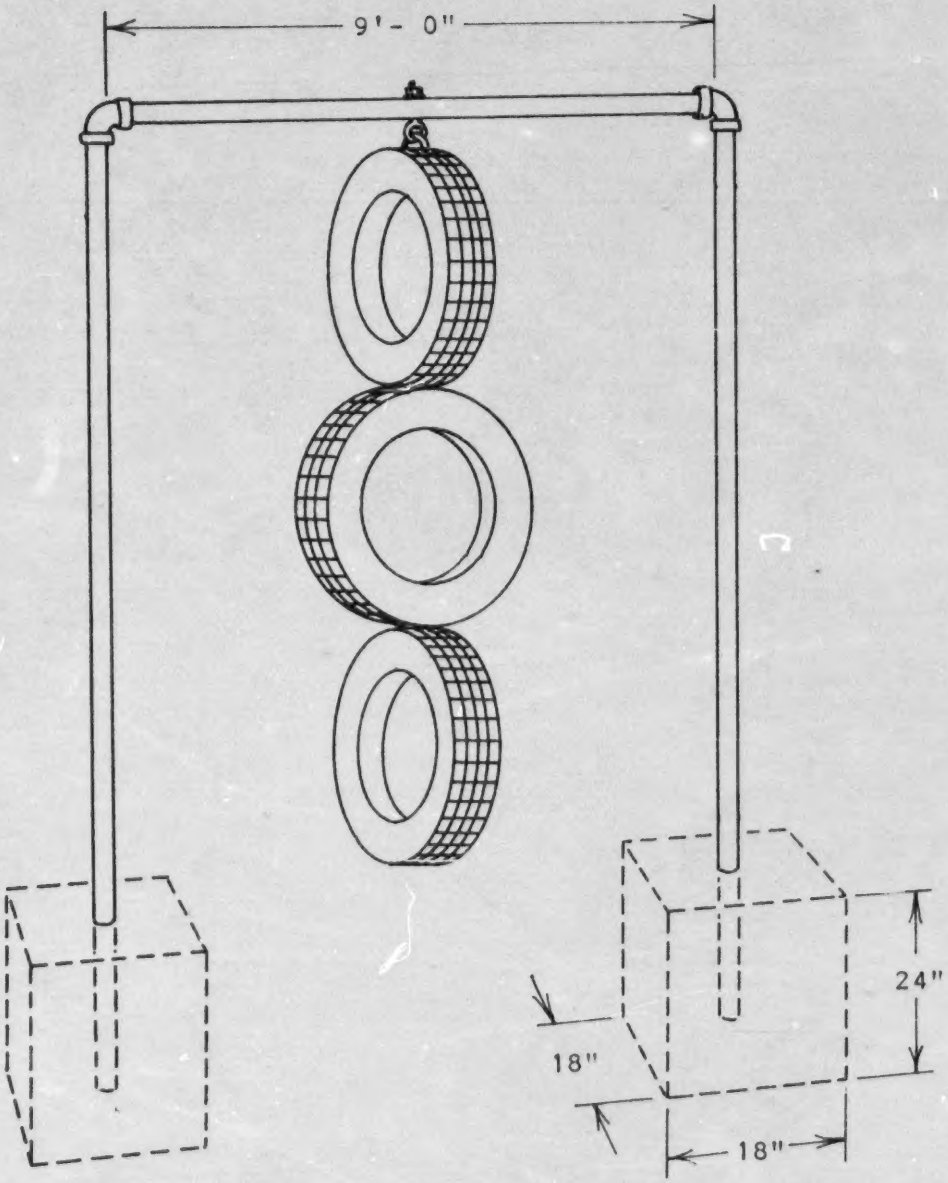
UNIT X

In the Shop

Choose three tires of different colors and find the diameter lines of the tires as explained for Unit III. Find the contact points of the three tires by butting them together with the diameter lines aligned. Use tools and method described in previous units to drill ½" holes in the tires at the contact points. The tires can now be connected using Construction Method C (page 48). Weep holes should now be drilled in each tire, in the center of the diameter line marked on the sidewall (two holes in each tire). Prepare the 4" X 4" posts following the measurements specified in the drawing for this unit. Cut notches in the posts as shown, and to lessen the chance of the nylon line chaffing, rasp and sand the posts where the line will be rubbing. (Note that the notches are cut into the corners of the posts to retain as much strength of the posts as possible.) When the posts have been nosed, notched, and sanded, the students can prime and paint them. While the posts are drying, determine the placement of the 5/8" holes necessary to thread the nylon line through the three tires. Using a diameter line as a guide, place a straight edge parallel to this line and about 10" from it on each side. Draw these lines lightly across the sidewalls of the three tires. Square down to the mid-point of the tire tread from the end of each line on each tire, and mark the positions of the 5/8" holes as needed for threading the nylon line. One and one-half inch roofing nails should now be driven into the posts as in Units VI and VII.

At the Site

Locate, orient, and excavate the post holes using tools and procedures as described for Unit VIII. Install the posts using tools and methods described for the same unit. Note that the notches face away from the center of the unit. The connected tires should now be placed on the ground between the two supporting posts. Thread the nylon line through the 5/8" holes in the treads on one side of the tires, around the base of one post, and through the holes on the other side of the tires. Cut the line, as described for Unit III, allowing enough extra for wrapping around the second post and finishing as shown in the drawing (a modified version of Construction Method H, page 50).



UNIT XI

46

In the Shop

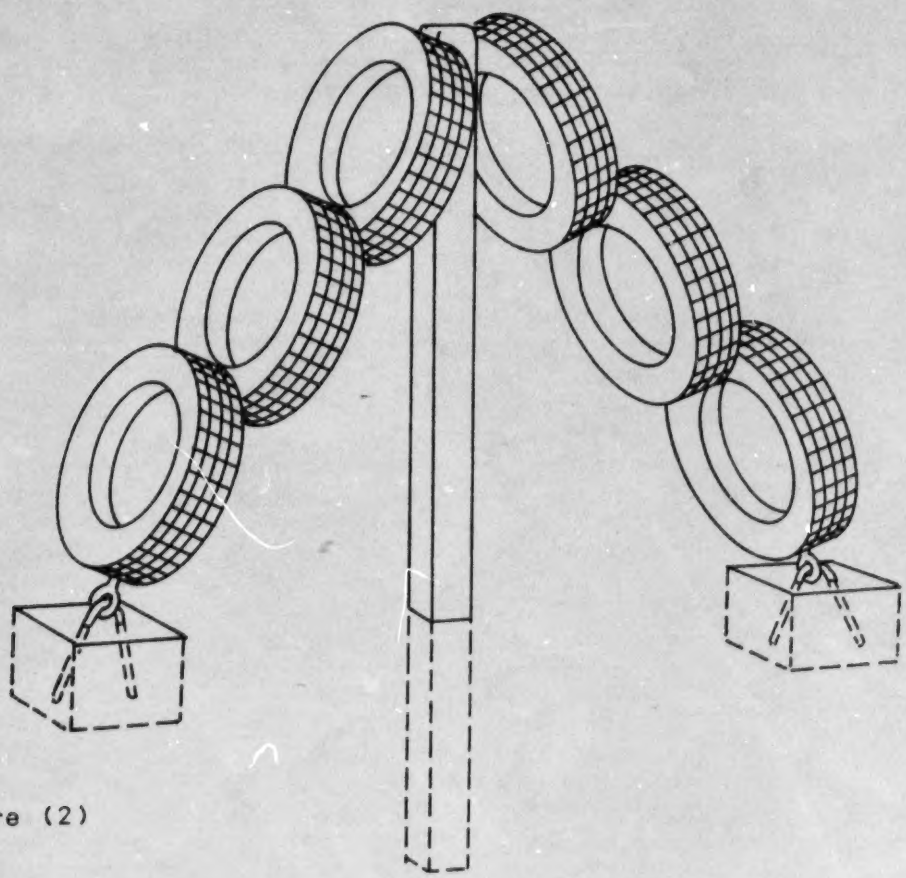
Select three tires of different colors. Butt them together and find the center lines as with previous unit. At the points of contact drill 1/2" holes in the same manner as with other units. In the tire selected for the top position, drill two 1/2" holes exactly 180° from the first hole and in the mid-point of the tread area to accommodate the 1/2" U-bolt. In the tire selected for the bottom position, a 1/2" weep hole should be drilled with a 1/2" spade bit. Weep holes should be drilled on each side of the assembly holes in the bottom side of each tire. These holes can be positioned by using one of the 2" x 4" blocks as a guide, and drilling the holes at each extremity of the block. Connect the tires by using Construction Method C (page 48), and secure the U-bolt and connected eye bolt to the top tire using Construction Method G (page 50). Measure, cut, ream, and thread the pipe. Screw the two elbows on each end of the top rail. The elbows should be well tightened and should be positioned so that the students can attach both legs in a parallel position. This can be easily done by hand tightening the leg pieces or two shorter pieces of 2" pipe into the elbows and using them as levers. When the elbows have been attached securely into position, the levers are removed and the top rail is ready for drilling. Find the center of the length of the top rail, mark with a prick punch, and position the rail on the table of a drill press. When the mid-point of the pipe's length is directly beneath the chuck, roll the pipe until a short length of 2" pipe (hand screwed into one of the elbows) is placed in a plumb position. The pipe can then be clamped in place with the mid-point ready to be drilled. Drill through the pipe, progressing from a 1/8" hole to a 1/4" hole, a 3/8" hole, and finally the 1/2" hole. Keep the pipe and bits flooded with cutting oil and use proper speeds to prevent damage to the bits. Prepare pipes for two coats of O.D. lacquer using methods and tools described for Unit IV.

At the Site

Follow the same procedures as described for Unit IX.

NOTE: This unit may be left free-swinging with the bottom tire about 6" above the ground, or may be anchored at ground level by using concrete blocks as in Unit XII.

Note: for post length see text.



12" square (2)

post footihg same as Unit VIII

UNIT XII

In the Shop

Use six tires (paired in color) prepared for this unit. Scribe diameter lines across the sidewalls of both sides of all the tires, using methods described for Unit III. For each side of the post, select three tires of different colors. Drill 1/2" holes in the mid-point of the sidewalls for joining, using Method C (page 48) and fasten the tires together. Drill a 1/2" hole at the mid-point of the tread area of the bottom tire, square down from the end of the diameter line and insert an eyebolt as in Method F (page 49).

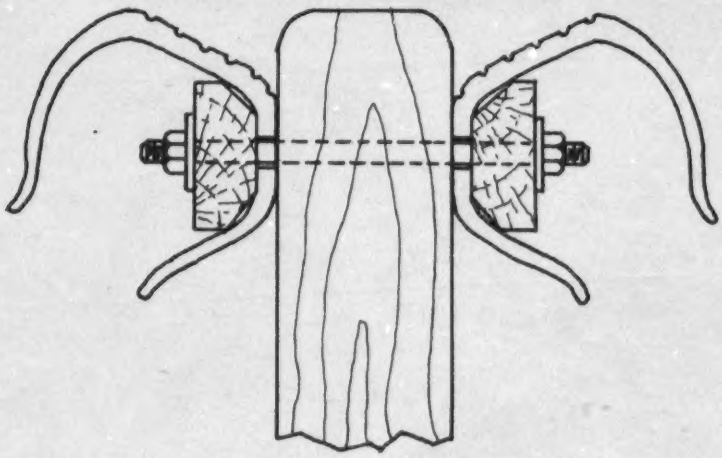
At this point some basic mathematics must be employed to find the correct length of the 4" x 4" post that will be above ground level. Find the overall length from the top of the top tire to the end of the screw eye. On a large sheet of paper,

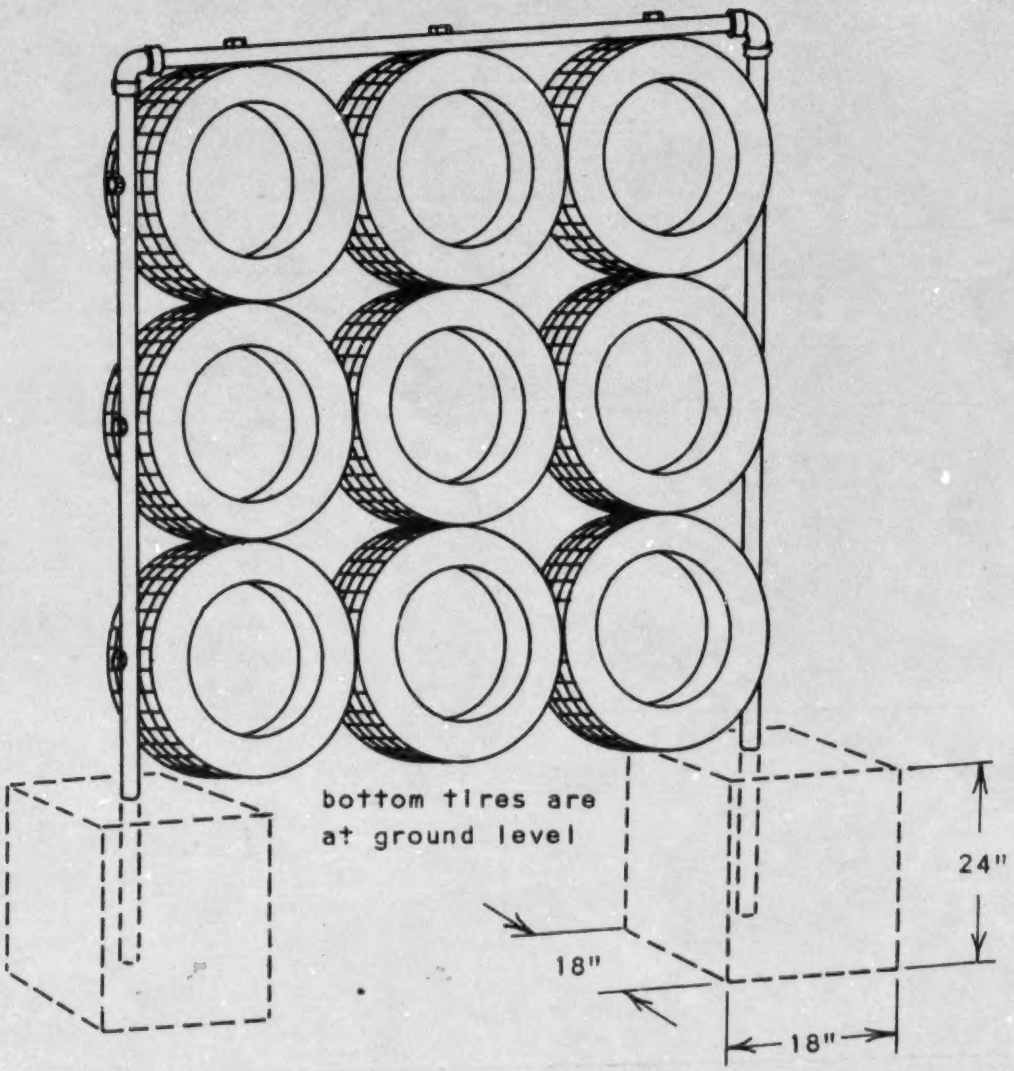
draw a vertical line about 18" long to represent the post. From the top of this line, at a 30° angle, and, using a scale of 3" equals 1' (1/4" will then 1"), draw a second line the length of the tires and screw eye down toward the bottom of the paper. From this last point, draw a horizontal line back to the vertical line (forming a 90° angle with the vertical line). From this point to the top of the vertical line will be the length of the post needed above the ground. Allowing an additional 24" to be placed below the ground, cut the post to the correct length.

To fasten the tires to the post (see drawing below), either a 1/2" rod can be threaded at both ends, or two 1/2" bolts with the heads removed and welded together can be used. For the former, drill a 1/2" hole approximately 3" from the top of the post. For the latter, the hole must be large enough to accommodate the welding bead. Nose, sand, and paint the post. With the tires and post positioned on the floor, locate and drill a 1/2" hole in the top tires for attaching them to the post. To hold the screw eyes to the anchor blocks, bend the 18" lengths of reinforcing rod (or anything similar) into the shape of a "U" (see illustration).

At the Site

Install the post using the same procedures as previous units. After the concrete has hardened, bolt the tires to the post. Prepare excavations for the concrete anchor blocks as shown in the drawing. Brace the tires into position using 2" x 4" lumber. Insert the "U" shaped rods in the screw eyes and pour the concrete.





UNIT XIII

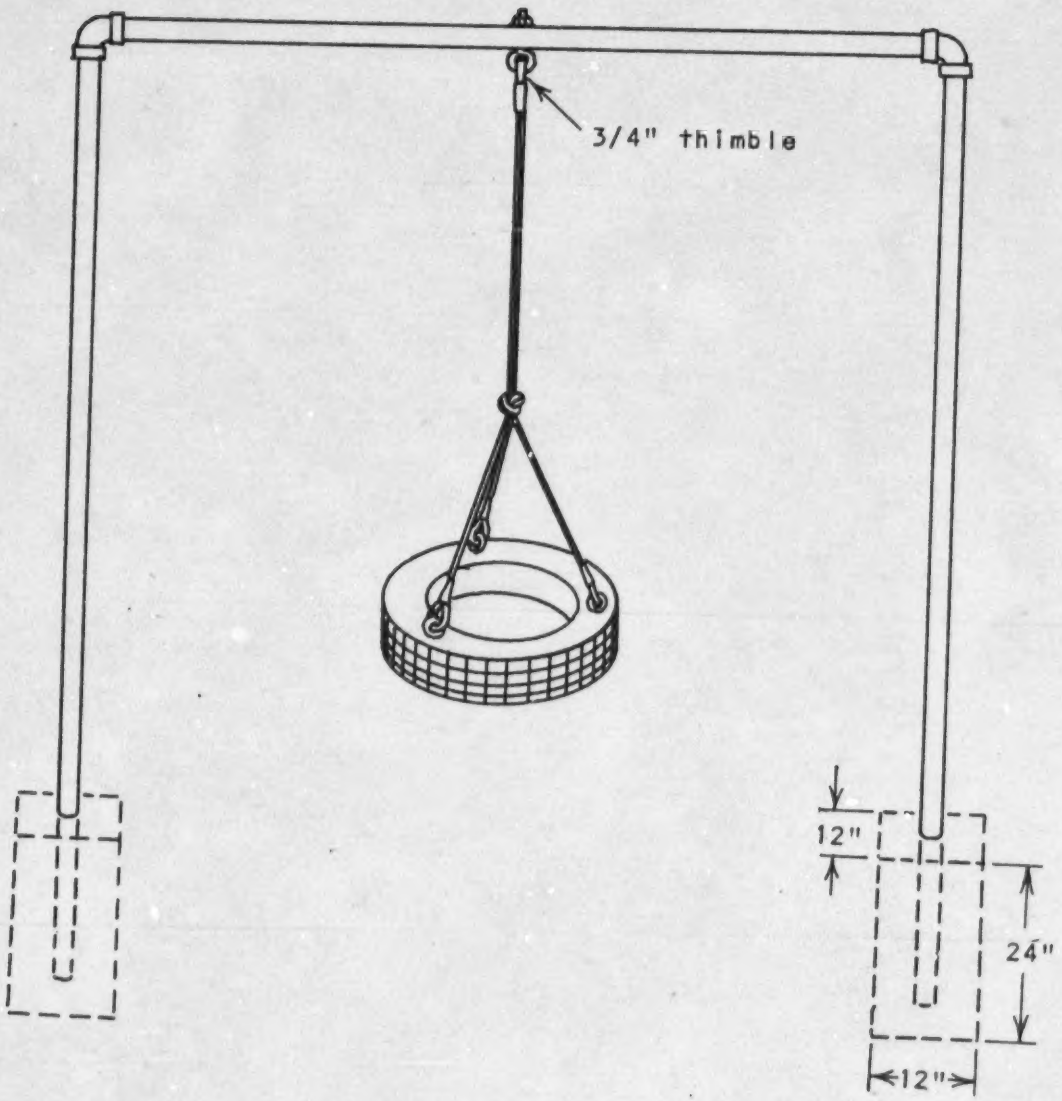
UNIT XIII

In the Shop

Arrange nine prepared tires IN THE CORNER OF A ROOM if possible. This method of placing the tires automatically positions them in a square block. Use previously described methods to find the diameter lines of the three rows of tires, both vertically and horizontally, and mark them lightly across the sidewalls. Then, as with other units, square down from the ends of each diameter line on each tire, and in center of the tread area drill 1/2" assembly holes. Use Construction Method C (page 48) to join the tires to one another. Prepare the 2" pipe legs according to the specifications and determine the length of the top rail (this length will vary according to the size of the tires used for the unit). To accomplish this step, attach the 2" elbows to the end of the leg pipe so that it is moderately tight. Then place the pipes against the block of tires where they will eventually be anchored and face the open ends of the elbows toward each other. This will determine the length of the top rail. When the top rail has been completed, assemble the frame and square it as with Unit IX. With the block of tires still on the floor, the frame should be placed in the position where it will eventually be secured to the tires. The frame should then be raised from the floor and supported by blocks thick enough to put the frame in line with the assembly holes in the tires. This determines the proper placement of the 1/2" assembly holes to be drilled in the 2" pipe. Use tools, machines and procedures that were used in drilling the top rail of Unit XI to complete the top rail and legs of this unit. After drilling, the pipes for this frame should be cleaned, sanded, and painted as with other units. The block of tires should now be secured to the pipe frame making sure that bolts pass through the pipes first and then through the tires. This places the nuts and ends of the bolts inside the tires where they will not injure the children playing on the unit. This unit is not disassembled for transportation.

At the Site

The students use the same tools and methods for location, excavation, and installation of this unit as were used with Unit XI.



UNIT XIV

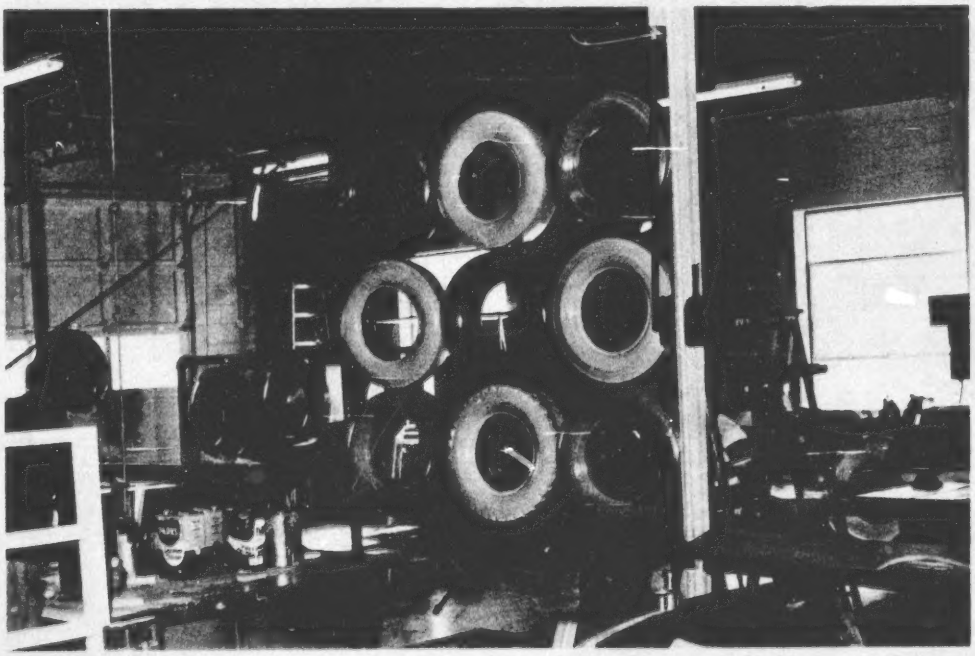
UNIT XIV

In the Shop

Drill three 1/2" assembly holes in the center of the sidewalls of the tire prepared for this unit, using methods and tools described for Unit IV to position the holes 120° apart. Drill three weep holes in the bottom sidewall between each of the first three holes. The eye bolts should then be secured to the tire using Construction Method D (page 48.). Build the pipe frame using the dimensions shown in the drawing and the tools, methods, and assembly procedures as with Unit XI. Cut three lengths of nylon line, allowing approximately 12" for knotting and looping around the thimbles (note that the top thimble which holds three lines is 3/4"). Attach a line to each of the eye bolts, using Construction Method H (page 50). Knot the three lines together as shown in the drawing and after judging the desired height of the tire from the ground, secure the three lines and the thimble to a 1/2" eyebolt. (The eyebolt will be fastened to the frame at the site.)

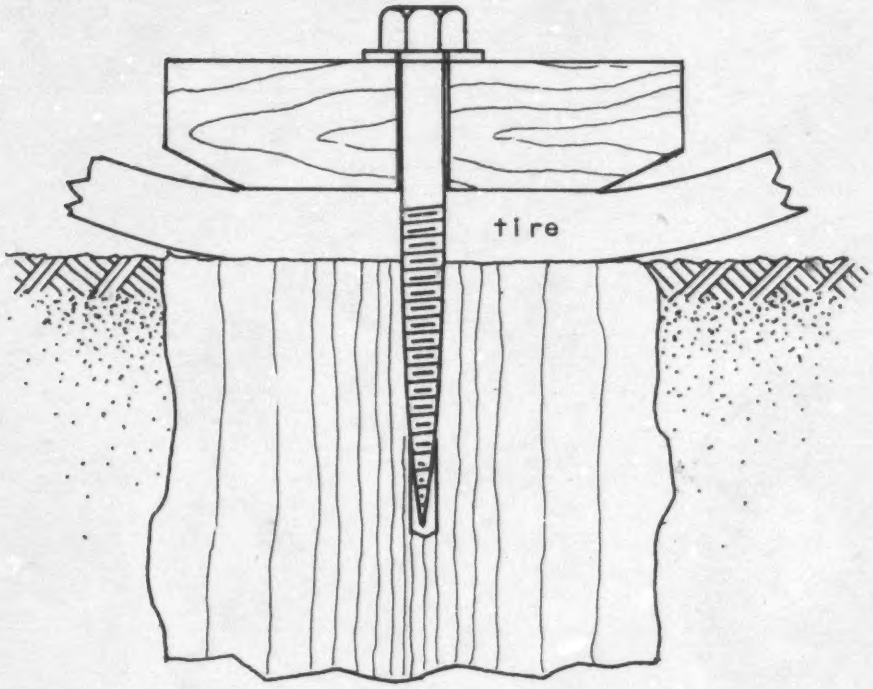
At the Site

The students should use the instructions for the installation of Unit X.

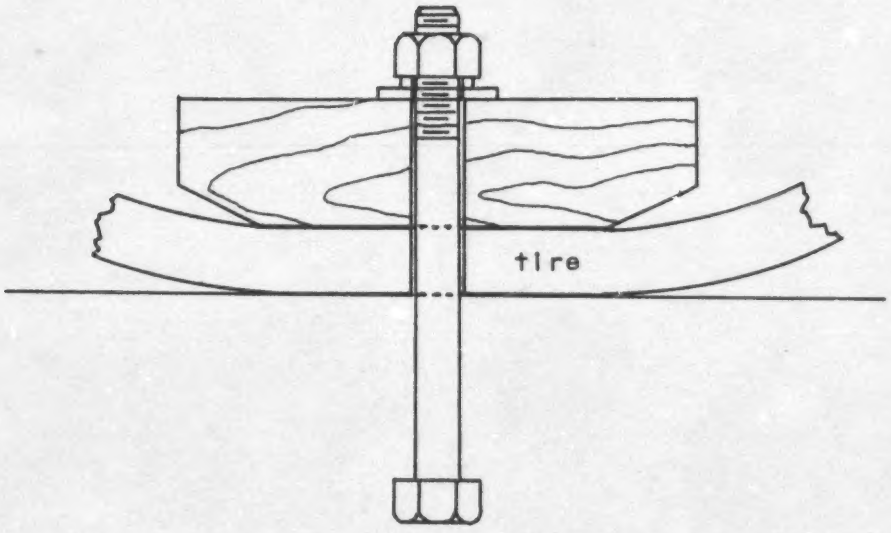


Unit XIII being completed in the shop

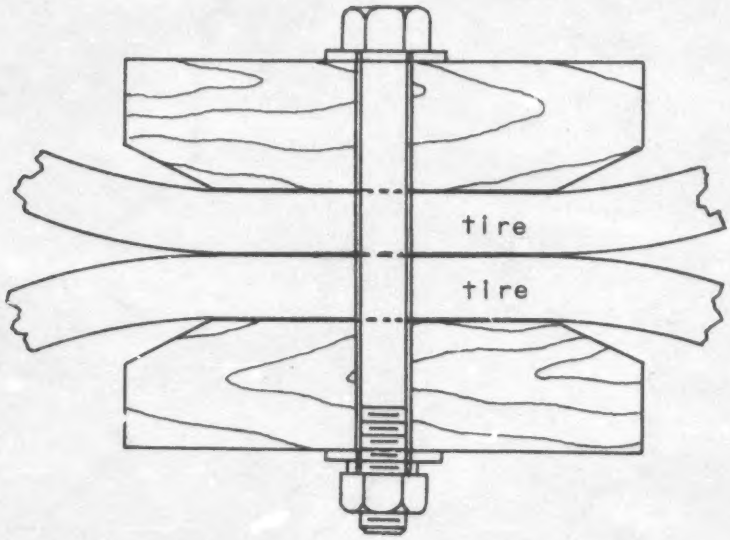
Note: all "Method" drawings are 1/2 scale



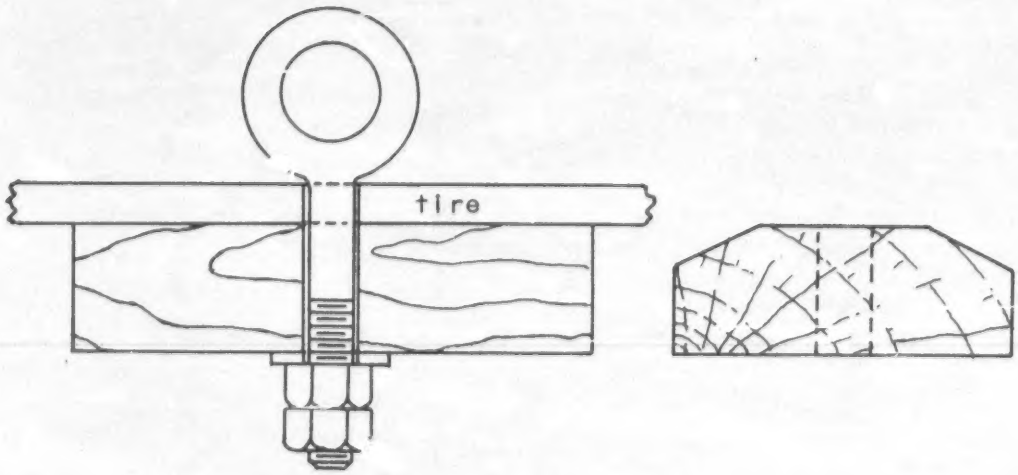
Method A



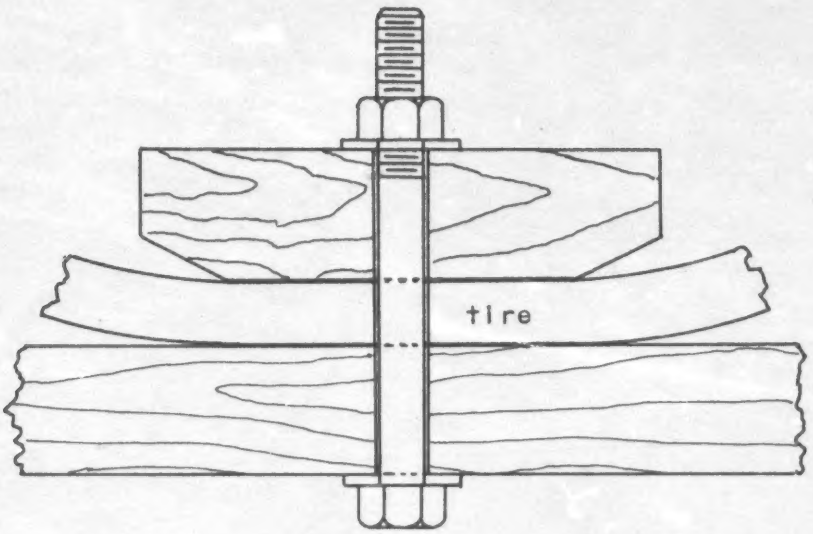
Method B



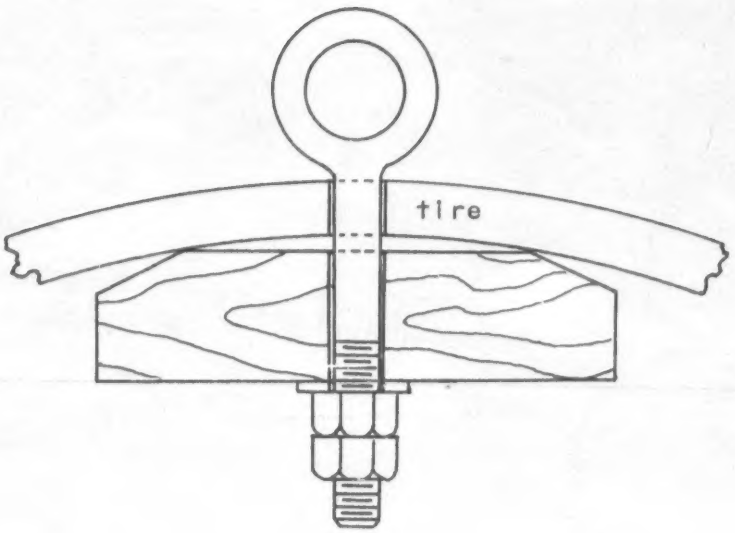
Method C



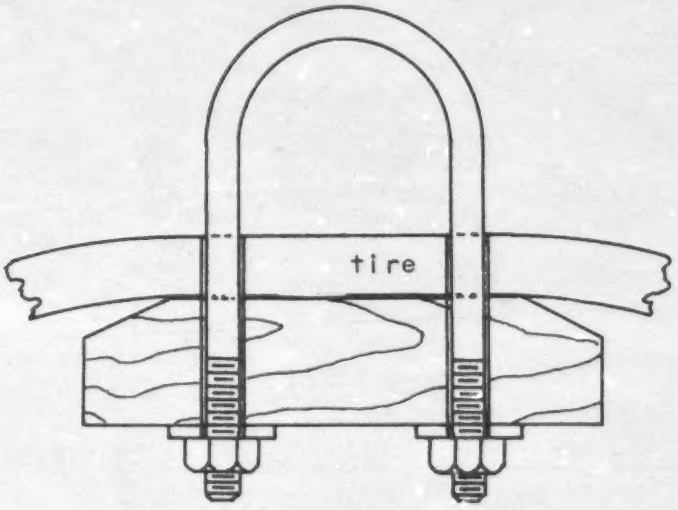
Method D



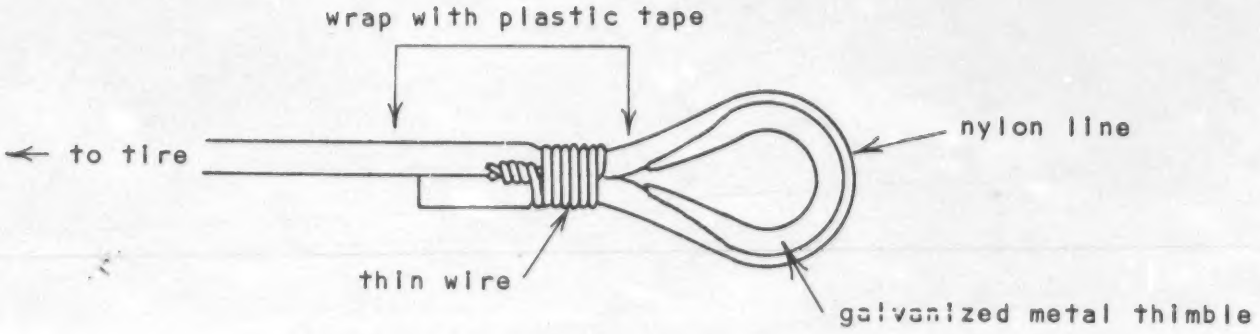
Method E



Method F



Method G



Method H